Engineer

THE MAGAZINE FOR ARMY ENGINEERS

SUMMER 1984

AUTOMATING THE ENGINEERS

ALSO: MODERNIZING CONSTRUCTION EQUIPMENT

THE M919 ACE □ ENGINEER MODELING PROGRAM

The Division Engineer

A Personal Viewpoint

by LTC Alfred J. Nahas

Because the division Engineer battalion commander's command responsibility will be reduced during wartime, it would be a mistake to misuse his significant role as the division Engineer. Both as a staff planner and as the coordinator for numerous Engineer battalions, he is the key to synchronizing combat units within the division sector.

In a realistic division front, the division Engineer battalion would be fragmented. The line companies in direct support of the brigades would receive all of their missions from their brigades. The general support company will often be sent to reinforce one of the other line companies or it may be tasked to support the cavalry. This leaves only the bridge company under battalion control.

The direct support companies depend on the nearest forward area supply train (FAST) for their logistics support while all Class IV and Class V are doctrinally provided by the maneuver units. The Engineer battalion headquarters maintains operations and logistics status to ensure mission accomplishment and reinforcement as required.

Realistically, the distances involved make any direct involvement difficult, even in logistics support. Consolidating friendly obstacle lists or sitings of enemy obstacles is a major reporting function in the battalion. The battalion headquarters is not significantly taxed, however, with monitoring its own companies.

The division Engineer has two roles. First, he coordinates the efforts of all Engineers working within the division sector. In wartime the division would doctrinally be supported by at least two corps combat Engineer battalions and a combat support equipment company composed of heavy earthmoving equipment. The division Engineer must justify and request the support from corps. These assets may come under either direct support or operational control (OPCON) to the division with new doctrine leaning more toward OPCON, particularly in the attack.

Additional fixed and float bridge companies may also be sent to the division sector. The corps battalion and group headquarters offer the division additional planning capability for future operations such as river crossings, obstacle systems and repair or construction of main supply routes (MSR), airfields or logistics bases. All of the missions for this brigade size force are assigned through the division Engineer.

The division Engineer's second role is to provide Engineer expertise to the commander. He should be the expert on the opposing forces' Engineer capabilities and dispositions and proposes Engineer essential elements of intelligence (EEI) to the general intelligence officer. He should also be the expert on the mobility and countermobility aspects of the terrain and should anticipate the Engineer impacts on the division maneuver scheme. While the G-2 tells what terrain impacts face the division, the division Engineer tells the commander how to reinforce or overcome them.

In the attack, as the G-2 analyzes friendly avenues of approach, the division Engineer focuses on obstacles that can impede our movement. He analyzes the enemy's capability and doctrine to determine how the

(Continued on page 37)

Editor's note: ENGINEER invites all readers to submit "Letters to the Editor." Topics can be on any article or subject that has appeared in ENGINEER, or on any subject you feel is controversial in military engineering, leadership, or the United States Army. All submissions should include the originator's name, position, unit and unit address.

Engineer

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On The Cover

The DAS3 (Decentralized Automated Service Support Systems) Field System is used in non-divisional direct support and general support units. Especially designed for today's Army, the DAS3 significantly aids soldiers in consolidating reports in personnel, supply, and management. (Photo courtesy of Tactical Data Systems, General Electric Company.)

FEATURES

DEPARTMENTS

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Bulldozer Blade Kit

The Army's Armor and Engineer Board recently gave the go-ahead for further testing of a bulldozer blade kit for the M-1 Abrams tank developed at the Belvoir Research and Development Center, Ft. Belvoir, VA.

For many years, Army units have mounted bulldozer blades on some of their tanks to clear debris and rubble, improve defensive fighting positions and breach obstacles.

In 1978, Chrysler Defense studied the possibility of adapting the M9 bulldozer kit used with the M60 tank to fit the M1. They recommended designing a new kit that would use moldboard geometry to improve driver vision and system performance and take advantage of the lower profile of the M1 tank. Recommendations also included up-to-date hydraulic components and a quick coupling and release mechanism.

Based on the recommendations of the study, the Center awarded a contract to Barnes and Reinecke, Inc. in 1981 to build a prototype kit which was tested at Ft. Knox the following year. It mounts on the lifting eyes and towing lugs and is powered by the tank's electrical system.

The crew of an M-1 tank uses a dozer blade being developed by the Army's Belvoir (VA) Research and Development Center to clear a path for the tank.

Terrain Analysis Tool Assembly

In the future, combat commanders will rely on automated systems for up-to-date terrain information. Scientists at the U.S. Army Engineer Topographic Laboratories (USAETL) are assembling a prototype terrain data extraction and analysis system which will help make automated topographic support a battlefield reality.

This Terrain Analyst Work Station (TAWS) will use digital techniques to extract, interpret and display terrain data. TAWS takes advantage of recent advances in microcomputer technology, analytical photogrammetry, computer-assisted photo interpretation and geobased information processing. These technologies will eventually allow soldiers in the field to produce and update digital terrain data bases.

The Defense Mapping Agency (DMA) plans to supply digital topographic data for the terrain analysis community and other Army users. DMA data, however, may not always be available for every site where battles may be fought. Combat itself can drastically change the natural landscape, making terrain information that was accurate yesterday obsolete in a matter of minutes. TAWS capabilities can fill the gaps which may exist between the information that's available and the coverage that's needed.

Using TAWS, analysts will be able to extract terrain elevation and feature data from a variety of sources—including maps, charts, aerial photographs and satellite imagery. They can then digitize this information and use it to update existing data bases or create new ones.

ETL scientists are rapidly assembling the hardware and software needed to make TAWS a prototype terrain data management tool. The system's central 32-bit microcomputer will be delivered in May along with two disk drives and related peripherals. Much of the software which will be used for the project has already been developed in the laboratory; contractural efforts are underway to convert these programs to run on TAWS.

Project engineers expect to have TAWS ready for laboratory tests by June 1985.

New Hydraulic Fluid

A fire-resistant hydraulic fluid that will reduce the chances of crew-compartment fires in the Army's combat vehicles is currently under development at the Belvoir Research and Development Center's Materials, Fuels and Lubricants Laboratory.

The need for a hydraulic fluid with increased fire protection was uncovered in an Ordnance School post-battlefield analysis of the 1973 Middle East War. Hydraulic fluid fires in armored vehicles were clearly identified as contributing to the loss of life and equipment. These fires usually occurred where hydraulic systems lines and components were exposed.

Subsequently, the Army replaced its petroleum-based hydraulic fluid (MIL-H-6083) in 1974 with an Air Force/Army developed, synthetic hydrocarbon based substance (MIL-H-46170) that featured improved fire-resistant properties.

However, since the improvement in fire-resistance was marginal, the adoption of MIL-H-46170 was considered an interim solution. To develop a truly nonflammable hydraulic fluid, a completely halogenated material is being used. Tests show that this fluid can be diluted with up to 20 percent of currently-used hydraulic fluid without losing its fire-resistant traits.

Presently, efforts are directed toward developing a fully formulated, nonflammable hydraulic fluid that can be used in existing hydraulic systems. Factors that may affect the eventual fielding of this fluid include the high specific gravity and volatility of the base fluid.

MICROFIX

MICROFIX, a new automated Storage and Retrieval System for mapping information, is being evaluated under a joint effort by the Belvoir Research & Development Center and the U.S. Army Force Command.

MICROFIX will assist the terrain analysts to process, store and retrieve terrain data on a more realistic "Real Time" basis. It will serve as a transition between the manual systems currently in use and the fully automated systems of the future.

Microfix consists of a microcomputer and 10 subsystems that have been certified for field use. Expansion cards enable the central processing unit to control the devices and a 128 kilobyte random access memory card more than doubles the computer's memory giving the system greater data processing capacity.

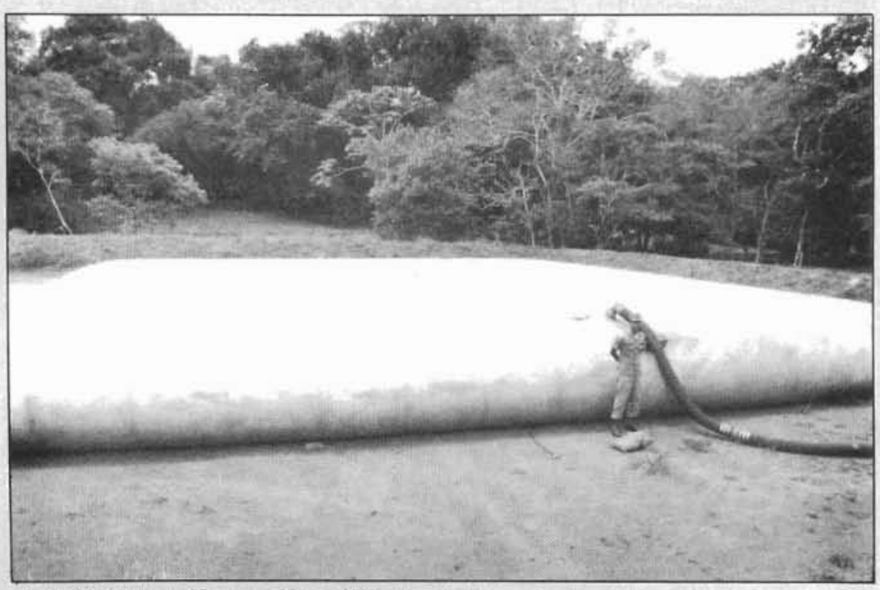
So far, the Belvoir R&D Center has purchased six of these systems for evaluation at a cost of $35,000 each. These units are currently located at Ft. Bragg, NC; Ft. Lewis WA; Ft. Shafter, Hawaii, the U.S. Military Academy; the Defense Mapping School and the Center's Combined Army Support Laboratory. Operator training has been completed and the results of the evaluation should be ready early next year.

Larger Fuel Storage Tank

A 210,000-gallon collapsible fuel storage tank developed by the U.S. Army Belvoir Research and Development Center, Ft. Belvoir, VA, has been type classified.

Work on the tank began as part of a program to develop large capacity fuel storage containers that can be set up with minimum effort. Standard containers currently available, a 420,000-gallon bolted steel tank and a 1,050,000-gallon hasty storage reservoir, both take considerable time and effort to install and require a great deal of logistics support. The largest collapsible tank currently in the Army's inventory only has a 50,000-gallon capacity.

The new tank will bridge the gap between the 420,000-gallon steel tank and the 50,000-gallon collapsible tank.



A 210,000 gallon collapsible fuel storage tank has been developed for quick supply on the field.

Engineer People

MG E. R. Heiberg III (right) and LTG Joseph Bratton (center) met with former President Jimmy Carter Sept. 15, 1979 in Mobile, AL to discuss damage done by hurricane Frederic that year. At the time of this photo Heiberg was Chief of Civil Works in the Office of Chief of Engineers.

Engineer of the Year

This year's award for the U.S. Army Forces Command Engineer of the year was presented to COL Ralph A. Luther, former director of Engineer and Housing at Ft. Bragg,

COL Ralph A. Luther

NC. Luther, who recently assumed duties as engineering officer for the National Security Agency at Ft. Meade, MD, received the award for his service at Ft. Bragg. He credits his selection to a conglomerate of many different positions in the Army which gave him the training and ability to learn new jobs quickly. "I've worked with FORSCOM since I've been here," he said. "I guess the daily relationships that we have here left them with the impression that Ft. Bragg is doing better in the Facility and Engineering business than any other installation within FORSCOM.

Editor's Note:

Training developers at the Engineer School's Topographic Engineering Branch are revising TM 5-232, *Elements of Survey*. This revision is necessary because of doctrinal changes and new equipment being fielded with the Topographic Support System. The new version will include revised portions of TM 5-441, *Geodetic and Topographic Surveying*; TM5-442, *Precise Astronomic Survey*; and the survey specifications published by National Ocean Survey, formerly NOAA. TM 5-441 will become obsolete when the *new* FM 5-232 is published. FM 5-232 is scheduled for review in the field in 1987 with publication in 1988. *(This supercedes any information which has appeared in prior publications).*

Next Chief of Engineers

MG E.R. "Vald" Heiberg III will become the next Chief of Engineers on Sept. 14, 1984, according to the Department of Defense.

Heiberg, whose nomination by President Reagan was announced on May 11, will succeed LTG Joseph K. Bratton, who will retire from military service on September 30. Heiberg will also be promoted to Lieutenant General when he assumes his title as Chief of Engineers.

Heiberg is currently serving as program manager of the Ballistic Missile Defense Program under the Office of the Army Chief of Staff. He has been assigned to this position since May 1983.

As Chief of Engineers, Heiberg will have the principal responsibility for the development and management of the nation's water resources programs, which include navigation, flood control, hydroelectric power generation, water supply for municipalities and industries, and recreation at Corps of Engineers' projects. In addition, he will be responsible for military construction for both the U.S. Army and the U.S. Air Force in the United States as well as overseas, and will also serve as the executive agent for the Army's worldwide Facility Engineering activities.

Heiberg's previous assignments include: Deputy Chief of Engineers; Director of Civil Works in the Office of the Chief of Engineers; Deputy Chief of Staff, Engineer, U.S. Army, Europe; Military Assistant and Executive to the Secretary of the Army; Chief, Manpower and Structure Team, Planning and Programming Analysis Directorate, Office of the Army Assistant Vice Chief of Staff; and as Special Assistant and Executive Assistant to the Director, Office of Emergency Preparedness under the Executive Office of the President of the United States.

Outstanding Citizens Honored

Two members of the Army Corps of Engineers received awards from the Governors of their states.

CSM (Ret) Grady F. Miles, formerly Command Sergeant Major of 2nd U.S. Army, Ft. Gillem, GA, was named as the 1984 Outstanding Military Citizen of Georgia by Gov. Joe Harris.

Dale Brown of the Georgia Intergovernmental Relations Office said that nominees for the award must be stationed in Georgia and have an outstanding record of military and community service. The Governor selects an outstanding military citizen each year from each armed service's active and reserve components.

Miles, who began his 30-year Army career in the Infantry before switching to the Combat Engineers, was honored during ceremonies in the Grand Ballroom of the Omni International Hotel in Atlanta.

His army career includes combat engineer duty in Europe and the United States, as well as 10 years with Special Forces units. A resident of Rex, GA, Miles is active in many activities such as coaching, Boy Scouts, church and the PTA.

The reservist honored was SFC Melvin Kelly of Company C, 926th Engineer Bn. in Huntsville, AL, who was given the Governor's Award by Gov. George C. Wallace in ceremonies at the State Capitol in Montgomery.

Kelley was one of 18 to receive the award, given annually to outstanding enlisted representatives of units in Alabama.

Gov. Wallace said the purpose of the award is to express the appreciation of the citizens of Alabama for the military men and women who preserve freedom around the world.

Selection for the award is based on military bearing, conduct, and outstanding performance of duty. Kelley was also chosen for his leadership ability and his contributions to his unit and community.

In civilian life Kelley is an Equal Opportunity Officer with Ballistic Missile System in Huntsville, AL.

CSM Miles (above) and SFC Kelley awarded as outstanding citizens.

Heiberg continued

Heiberg has also held command assignments in the United States and overseas as Division Engineer with the Corps' Ohio River Division; District Engineer with the Corps' New Orleans District; and as Commander of the 4th Engineer Battalion, 4th Infantry Division in Vietnam.

He is a 1953 graduate of the U.S. Military Academy and has earned three masters' degrees, including one in civil engineering from the Massachusetts Institute of Technology. He is also a graduate of the Army Command and General Staff College and the Industrial College of the Armed Forces.

He has served as one of seven Presidentially-appointed members of the Mississippi River Commission, and has also served as president of the Coastal International Association of Navigation Congresses.

Among his military awards are the Distinguished Service Medal, Silver Star, three Legions of Merit, Distinguished Flying Cross, Bronze Star Medal, seven Air Medals and two Army Commendation Medals.

CLEAR THE WAY

by MG James N. Ellis, Commandant, U.S. Army Engineer School

Goals Achieved, Challenges Ahead

Retaining our basic skills we must adapt to an automated future

This ENGINEER will be the last issue to be published during my term as Engineer School Commandant. Although the past 2½ years have gone by much too rapidly, and perhaps with too many things left undone, we have been able to make significant progress in improving training and equipment, updating doctrine, and in remodeling organizational structure.

For example, the May 1984 publication of FM 5-100, *Engineer Combat Operations,* is now the keystone Engineer doctrinal manual supporting the AirLand Battle. Engineer functional manuals subsequent to FM 5-100 (FM 5-101, *Mobility*; FM 5-102, *Countermobility;* FM 5-1-3, *Survivability;* FM 5-104, *General Engineering;* and FM 5-205, *Topographic Operations*) are scheduled for final publication within the next two years. These manuals will help to ensure the Engineers' ability to fight on the AirLand Battlefield.

The organization of Divisional Engineer Battalions has been remodeled in the Division 86 structure to reflect the demands of AirLand Battle. In addition, a smaller Engineer battalion has been designed to meet the requirements of the new Light Division. In each case, efforts were focused on improving the Engineers' capabilities in providing mobility, countermobility, and survivability to the combined arms team.

But perhaps the most significant progress over the past several years is our improved ability to train the Engineer team. The 12B Basic NCO Course (BNCOC), for example, is one of the best in the Army. Also the new 51H Basic Technical Course (BTC) will soon be joined by a 62N BTC and a 12F BNCOC. Furthermore, these courses are capped by a newly improved Advanced NCO Course (ANCOC), which was started at Fort Belvoir this summer.

Our officers will have a new 20-week Advance Course beginning in October 1984. This course should pose more challenge and provide more educational rewards for each student. I am convinced this will be the best Advanced Course in the Army.

All of these doctrinal and training improvements, as well as improvements in equipment (the Armored Combat Earthmover, the Small Emplacement Excavator and the Ground Emplaced Mine Scattering System, which are all approaching fielded status), are recognized in the series of studies accomplished over the past two years and culminated by the Functional Area Assessment (FAA) and the Mission Area Assessment (MAA) to the vice chief-of-staff, General Max Thurman. Much remains to be done, however, by MG Richard S. Kem as he becomes the Commandant of the Engineer School. I know MG Kem will ensure continued solid progress in the months ahead.

Automation of various Corps activities is one of the many challenges facing MG Kem. This issue of ENGINEER highlights several applications of computer-based automation. As these articles indicate, the Corps of Engineers needs officers and NCOs who are as comfortable with automation as they are with bridges, heavy construction, mines and demolitions. So the challenge of the future is not just MG Kem's, but a challenge to every military and civilian member of the Corps of Engineers to keep abreast of the rapid progress all around them while retaining their current skills.

I've enjoyed my duties as Commandant of the Engineer School more than any job I've had since my commissioning 28 years ago. The highlight of the tour was working at Fort Belvoir and around the world with the finest civilians, soldiers, and officers I've ever seen. I remain convinced that the Engineers will continue to "clear the way."

BRIDGE THE GAP

by CSM O. W. Troesch Jr., U.S. Army Engineer Center & School

NCOs Indebted to School Commandant

As NCOs, we continue to gain a stronger voice in the Corps, but face a more challenging future with automation

As you read or browse through this issue of ENGINEER, the Engineer School and Fort Belvoir will have undergone the traditional change of command ceremony. This ceremony symbolizes the passing of command responsibility from one officer to another and, in this case, the passsing of the duty as the Engineer School Commandant. To MG Richard S. Kem and his family, we bid a warm welcome and a pledge of continued support by the Engineer noncommissioned officers.

To MG James N. Ellis, our outgoing Commandant, the noncommissioned officers owe a great debt. Since the early days of his career when he was commissioned at the United States Military Academy, MG Ellis recognized the need for competent noncommissioned officers in the Engineer Corps. Throughout his years as a platoon leader, company commander, battalion commander and other assignments, he took a personal interest in the NCOs assigned to his command. Now his interest is exemplified in those NCOs who formerly served in his units and now hold key positions of responsibility and trust throughout the force.

Through the turbulent years of the 1960s and early 1970s, MG Ellis never lost faith in the noncommissioned officer corps. Now as the Engineer School Commandant in the 1980s, he was instrumental in helping to rebuild that "time-honored" corps of soldiers who are called the "Backbone of the Army."

In every challenge effecting NCOs and soldiers, his influence and guidance was evident. Through his efforts, NCOs gained a stronger voice in enlisted matters. He helped to add an NCO perspective to the Engineer Corps' changing doctrine. SQTs and related enlisted literature were researched and written, in many cases, by NCOs. NCO courses such as the revised NCO Advanced Course which started in August 1984, were made more innovative and hard-hitting to train Combat Engineer NCO leaders, and became models for other branches to emulate. Although we currently have one Primary Technical Course (PTC) and one Basic Technical Course (BTC) in operation, additional PTCs and BTCs are planned for the future. This will further improve professional development in MOS 62N and 12F technical skills.

NCOs will also face new challenges in automated systems and yet they still must retain their current Combat Engineering skills. The future shows drastic increase in technical equipment and demands all soldiers and NCOs to become experts in these computer systems if they intend to win the AirLand Battle. Thanks to MG Ellis, we now have the opportunity to learn these new systems while still training in our traditional Combat Engineering skills.

All of these accomplishments merely highlight and demonstrate MG Ellis' genuine concern for the Engineer noncommissioned officers' professional development. They will serve as a tribute to his sense of what is good for the Army and its NCOs. For every NCO in the Engineer community, I say thank you. Your efforts have enabled us to "bridge the gap" and make our Engineer family one where excellence is a standard and not an exception.

We wish you and Mrs. Ellis continued success in all of your future endeavors, until we serve together again overseas or here at home.

Directorate of Evaluation and Standardization (DOES)

Standardization Program:

The Directorate of Evaluation and Standardization (DOES) is the Engineer School manager for the Army Standardization Program. This program identifies tasks or procedures in Army units which should be standard throughout the Army.

Therefore, if certain tasks are trained and implemented in the same manner in all similar Engineer units, soldiers will not be required to be retrained in a new unit's method for accomplishing the same task. DOES serves as the interface between the Engineer School, Engineer units and TRADOC in this area.

If you, as an individual soldier, know of a task or procedure which should be considered for standardization, please send it to the Directorate of Evaluation and Standardization at Ft. Belvoir.

Professional Development Book:

The Engineer School (USAES) has recently completed distribution of the Engineer Enlisted Professional Developmental Book to each active Engineer unit. This book covers everything that an enlisted Engineer—grades E1 to E9 needs to know for career planning and professional development. If your unit has not received its distribution of this valuable development reference, please contact SFC Wagner, Engineer Proponency Officer, ATTN: ATZA-EP USAES, Ft. Belvoir, VA 22060. AV 354-2287/4172.

E7 Selection Board Review and Analysis:

After a promotion list is published, the question arises, "Why wasn't I selected?" Promotion board members provide a review and analysis report to the Soldier Support Center at Ft. Benjamin Harrison and to the commandant of each proponent school after each board. These reports contain observations by the board of what generally was wrong with the records they reviewed.

Here is a brief summary of the major findings: contradictory information in promotion packet; poorly written EERs; out-of-date photos; height/weight standards not being met; military education lacking, and old Article 15s. The Engineer Proponency Office has distributed copies of the FY 84 board's report to each active Engineer unit worldwide.

Any units not receiving a copy should contact the Engineer Proponency Office ATTN; ATZA-EP USAES, Ft. Belvoir, VA 22060. Remember, that to the board your record (Official Military Personnel File) is you. Your file must be accurate and up-to-date. Take a little time out to write for a copy of your file from Ft. Benjamin Harrison and make sure it is accurate.

Directorate of Training and Doctrine (DOTD)

FM 5-742 Revision:

An updated FM 5-742, *Concrete and Masonry,* should be available to field troops by FY85. Currently under revision by the Engineer School, this manual incorporates the latest information on air-entrainment and mix design.

Department of Military Engineering (DME)

ENCOA Preparation:

Noncommissioned officers who have been selected to attend the Engineer Noncommissioned Officers Advanced Course should prepare themselves in mathematical and language comprehension skills prior to their arrival at Ft. Belvoir. Upon notification of selection, personnel concerned should contact their Education Center and seek information and guidance on how to upgrade these skills to a 12th grade level. The NCO Student Detachment sends study materials (especially mathematics pamphlets) which will help those who have problems.

It is recommended that personnel who have been selected to attend the course and who have not received the packet at least 90 days before reporting to the course immediately contact the NCO Student Detachment by writing to: Commander, NCO Student Detachment, 3rd Battalion, U.S. Army Engineer School Brigade, Ft. Belvoir, VA 22060, or phone AV 354-6937/2809.

Department of Combined Arms (DCA)

Combat Simulation Center:

The Department of Combined Arms, has opened a combat simulation center. The center developed by the Tactics and Operations Division is organized to teach the AirLand Battle doctrine. This is accomplished through war gaming tactical operations of platoons through brigade level units on a realistic terrain board of the Fulda Gap area of Germany.

In addition to the terrain board, three mock M577s with extensions are being built. The M577s will provide the students a realistic combat setting. Control of the terrain board is through a telephone link connecting the brigade and Task Force HQ with the board. A realistic setting is also achieved through taped war sounds, camouflage nets and combat setting.

A computer program is being developed to support the terrain board play. The computer will determine ammunition expenditures and direct and indirect fire engagements, as well as combat support requirements.

For further information contact MAJ Booth at AV 354-2093.

The Automated Engineer Battalion

A Glance at the Possibilities

by CPT David F. Melcher

The time to automate the Combat and Combat Heavy Engineer Battalions is NOW!

As Engineers we have moved into an era of technology and advanced equipment. However, we have not complimented these gains with equally advanced methods of recording, scheduling and supervising our maintenance activities. We have devised elaborate personnel and training systems, yet we execute them in a painfully slow manner with manual information storage and retrieval. While the rest of society has adopted the microcomputer for running even the smallest enterprise, Engineers are still resorting to older methods which are becoming outdated.

In today's Engineer structure, microcomputers at the battalion level are also becoming a necessity. The large variety of equipment maintained and the size and complexity of its personnel and organization makes the Combat Engineer Battalion ideally suited for automation.

In computer jargon, an "application" is the computer's primary function. There are many applications which are readily obvious for the Engineer battalion. In the logistics/supply area, for example, ordering tools, building materials and ammunition, and maintaining accurate accounts for supplies on-hand, on-order, or backordered can be improved.

Ways of conducting inventories and accounting for personnel and equipment can also be improved. For example, we can achieve better ways to record and order publications. Record-keeping of legal and deployability status is also feasible with a personnel data base management system. Individual training, weapons or physical qualification results, and proficiency testing can be easily maintained for reports and schedules as well as for establishing training priorities.

Possibilities, then, are limitless. Maintenance, for example, is an ideal application for building confidence in an automated system. The risks involved in managing the maintenance process are relatively low, but the potential payoffs are extremely high.

Studies done by F. Warren McFarland of the Harvard Business School show that the variables of project size (relative to the unit's whole operation) can be combined in matrix form to show the relative risks in using a new EDP (electronic data-processing) application. Sounds like a lot of useless jargon, right? But let's examine it again in simpler terms.

The structure of the maintenance function is high since procedures that must be followed are clearly outlined in Army publications. Most data is simply transferred from manual to keyboard. Size is small for preliminary applications (the 2406 Readiness Report) and can be increased as individual successes are achieved. The nature of the system and of its software is not so technical that it cannot be readily adopted by most units. Most applications discussed can be created, debugged and put in place using only existing battalion staff personnel when given proper training with the computer.

This combination of automated features describing the maintenance function makes it a relatively low risk endeavor. Of course, formal planning and control tools are still needed during computer installation and initial programming. But a logically phased process of integrating the microcomputer into existing operations with emphasis on developing human abilities is certainly the key to successful introduction.

In making the maintenance system more manageable, the microcomputer can be used for several functions.

• **Data Storage and Retrieval**

Each byte of historical, operational and maintenance data is recorded on one of eight standard forms for each company by a maintenance management clerk, and stored in binders in the motor pool. The maintenance management clerk schedules services and is a liaison between the company maintenance section and the battalion maintenance officer. Because of the large volume of information, however, he is often tasked as a bookkeeper.

If this entry task was performed by a data entry specialist, the clerk would be free to perform a more valuable function and the volume of records could be reduced to one or two floppy diskettes.

• **Report Generation**

Frequently the battalion maintenance officer or company commander needs a status report on his equipment (the 2406 report) or an update on services due for the month. These services may range from a simple tire rotation to an extensive overhaul of a vehicle, yet each must be manually identified by scanning reams of forms. This inaccurate screening process usually results in missed or overdue services. If the clerk tries to correct his error with a false entry, the probable result is premature vehicle failure which is even more expensive in terms of labor and parts.

Scheduled services also tie into the parts resupply system because filters, lubricants and bearings must be on hand when the service is due. This cycle could be greatly simplified through automated programming designed to retrieve the required information accurately and timely. This will enable the commander to check that the maintenance operation is functioning properly and that the people required to perform these services are present when needed.

A myriad of other reports which could be better prepared by a computer include parts requests and follow-up actions on deadlined vehicles, maintenance allocation charts and lists of vehicle operators or alternates with the status of their military licensing and driving experiences.

- **Dispatching**

With a microcomputer and an updated database, vehicle dispatching could also be simplified. A simple entry of the operator's name and vehicle bumper number could produce a dispatch and a check on operational status, overdue services, operators qualifications and whether or not the previous dispatch had been closed properly. This sytem could greatly reduce the time it takes to dispatch an entire battalion in the event of rapid deployment for field exercises or alerts.

- **Reordering Function**

In addition to the services application, there is also need for better systems for reordering parts and record-keeping (Prescribed Load List).

Presently, each company PLL clerk manually notes in a bulky card file each time a particular part is used. If it is used three or more times in a quarter, it is added to the Prescribed Load List and stocked within each unit for future use. With current methods and manual bookkeeping, the usual result is that some key parts are overlooked and unit clerks swap parts to cover their oversights, resulting in needless downtime for vehicles.

Automating this function will not guarantee better data entry per se,

TACCS, an off-the-shelf computer and software system for battlefield combat service support missions. (Photo courtesy of Tactical Data Systems, General Electric.)

	High Structure	Low Structure
Low Relative Technology	Large Size Low Risk	Large Low Risk (subject to mismanagement)
	Small size Very Low Risk	Small Very Low Risk (subject to mismanagement)
	Large Medium Risk	Large Very High Risk
High Relative Technology	Small Med/Low Risk	Small High Risk

but it will improve screening stocks on hand with a computerized list rather than a card file. It will also enable the maintenance officer or commander to easily screen his PLL so that he can add parts which are essential to accomplishing his mission. More importantly, a conventional reorder point system used in commercial businesses could even be adapted to trigger prompt action when stocks are low. The applications are only limited by the programmer's or the commander's imagination.

• **Other Intangibles**

Although the automated maintenance system can save time, space and paper, the real value in the program is that maintenance clerks, officers and unit commanders are given more time to plan, monitor and check results. Not only do they have more accurate and more timely information at their disposal, they can also get the information they need in order to run an effective maintenance management program.

For the clerk, it permits easier comparison with his peers in like units to see where his records or stocks are flagrantly wrong. It also enables him to devote his time to working with company maintenance personnel to schedule repairs and services.

For the battalion maintenance officer, the computer helps him to execute his staff support function with greater ease. By reducing his control span over the number of support personnel, he can then manage the maintenance team function and minimize repetition.

For the unit commander, decisions on how to best allocate unit labor can be made by setting his priorities based on concise and reliable maintenance information. He also has a clearer idea of his equipment's condition and thus can more reliably report his unit status to superiors as well as supervise the maintenance actions of his subordinates with greater ease.

While it has often been said that "the Army runs on paper", the more sobering thought is that the Army's commanders and staff are administratively handcuffed by the paper they generate. As the Army moves into an era of technologically advanced machinery and increasing tactical complexity, the plodding maintenance and logistical support systems of yesteryear will no longer suffice. While automating many systems is not a panacea, it is a start in the right direction.

Meticulous care will have to be exercised in the initial stages to ensure that the problems of "Garbage in—Garbage out" and user reluctance to accept change are addressed. Once these are overcome and the proposed systems are in place, our maintenance personnel and commanders can get on with the business of ensuring that their units are prepared to deploy where and when they are needed.

The time for foresight is now, and the Engineer battalions are ideal vehicles to exercise the concept. Let's automate now to give our commanders the decision tools they need to properly allocate their soldiers' time as well as their own.

CPT David F. Melcher is a social sciences instructor at the United States Military Academy. He was a platoon leader, company XO, company commander, and battalion S-1 while assigned to the 14th Engineer Bn. (CBT)(CORPS) at Fort Ord, CA. He is a graduate of the Engineer Officer Advanced Course and has a master's degree in business from the Harvard Business School. CPT Melcher is a registered professional engineer in New Hampshire.

Computers and the Unit Maintenance Programs

Unit Status Reporting

One of the quickest and most visible applications of computerization could be the use of a vehicle status database to generate the 2406 reports. This report is currently prepared daily at each company (four reports in the battalion) and then consolidated manually into a battalion report for the use of commanders and maintenance personnel. It depicts:

1. **Equipment types, authorized and on-hand strength**
2. **Available days for use (drawn manually from another set of forms)**
3. **Specific vehicles that are deadlined and their nomenclature, serial number, reason for nonavailability, dates of nonavailability and part/job order status**

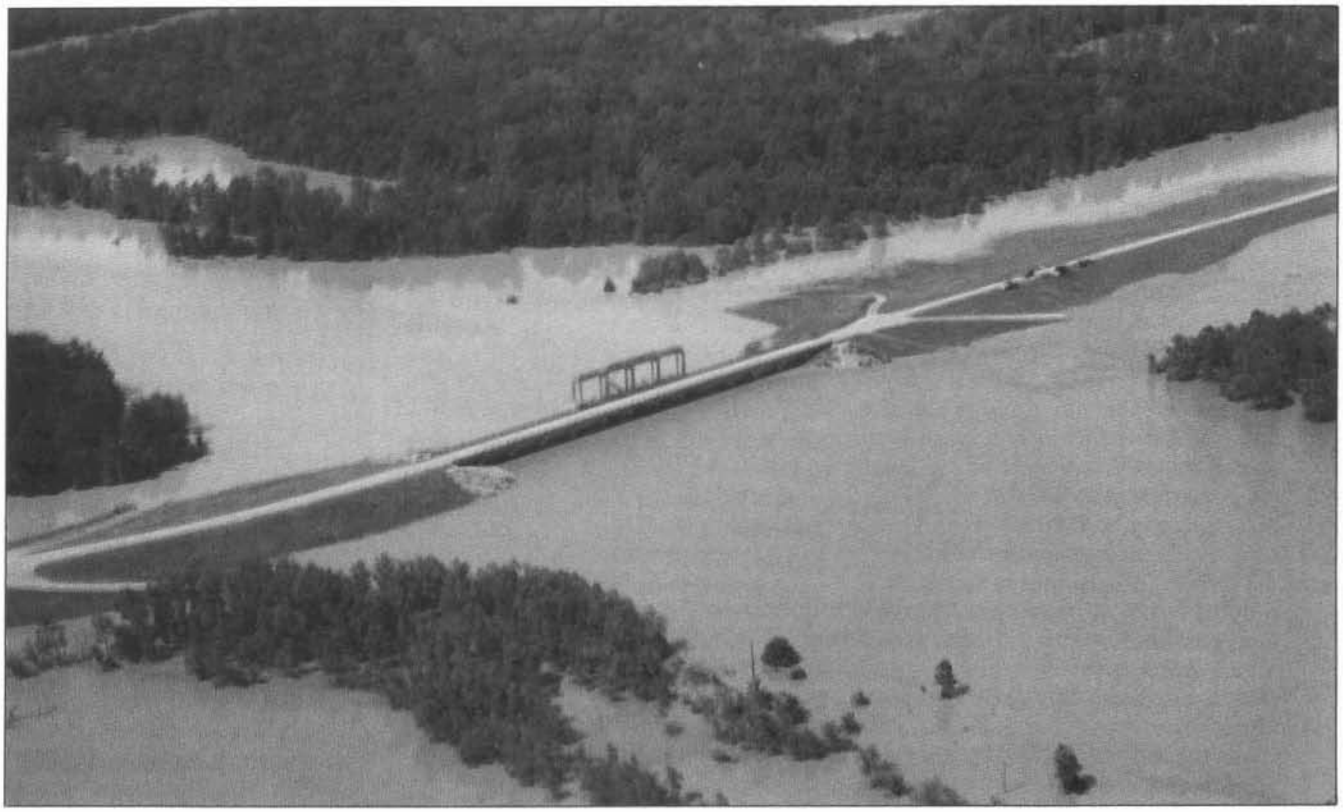
Presently, it takes each company maintenance clerk approximately one hour to update and prepare the report. It takes another hour for battalion personnel to consolidate the report, check it and query company personnel on vehicle status before the reports are submitted to the commanders. In units where typographical errors are frowned on, this process can consume immense amounts of time due to retyping and subsequent checking. With computerized output, the whole process would take roughly one-half hour to update and no time at all to print out. This is because all the information is stored in the databases, and once a change in status is recorded, a report can instantly be printed out. The immediate benefits are:

1. **Quicker report generation**
2. **Legible reports that are easy to check**
3. **Commanders at all levels get the same report**
4. **The system can be designed to include vehicles deadlined for overdue services (not widely done)**

This is just one example of an application that I know would be invaluable to unit commanders and maintenance personnel. The numerous others mentioned are equally invaluable.

Fighting Floods with New Technology

by LTC Stephen E. Shepard



Critical Operation—Structures such as the Steele Bayou Drainage Structure in Mississippi's Yazoo Basin are operated based on information received from the satellite. In a flat area such as the Delta, a few inches in error can mean thousands of dollars in damage. (U.S. Army photo.)

The electronic age, which has crept into the art of flood fighting, is aiding the Corps of Engineers. Automation is converting flood fighting techniques from desperate efforts of sandbags, confusion and prayers to a science of prediction, precision, and immediate response.

Almost annually, the Lower Mississippi Valley has suffered from devastating floods, limiting the socio-economic potential of this fertile, agricultural region.

Although a century of flood control efforts by the Corps of Engineers has greatly reduced flood damage, man has still not succeeded in changing the weather; eliminating floods is still an impossible task.

But recent technological advances have allowed the Corps, working with other federal, state and local groups, to improve its effectiveness in using the flood control works constructed during the past 100 years. These measures have resulted in significant savings by reducing damages and human trauma.

GOES Satellite

A great advance came in 1974 and 1975 when the National Aeronautics and Space Administration (NASA) launched two satellites dubbed MS-1 and MS-2. These first Geo-Stationery Operational Satellites (GOES) were placed in stationary orbit 22,600 miles above the

Pacific Ocean to collect various data such as water resources, agriculture, geology, forestry and meteorology.

In cooperation with NASA, the GOES now helps the Corps of Engineers' Vicksburg District to monitor the 2,300 miles of rivers and streams in its three-state, 68,000-square mile area of responsibility. Based on its need for immediate information concerning rainfall and river levels, the Corps was named a major user of the system, along with several other federal agencies.

Generally, each water resources project is tied hydraulically to all other similar projects. To manage the many reservoirs and flood control structures which protect the thousands of people in urban and rural areas and the vast acres of farmland, the Vicksburg District's hydraulic engineers need data to make accurate, timely decisions.

In less than one second, GOES satellite receives and transmits rainfall and river data from the million-square mile Mississippi River basin to the Corps' Waterways Experiment Station (WES) in Vicksburg. This is a vast improvement over the old days when all river and rainfall information was telephonically transmitted by local gage readers who were at the mercy of damaged phone lines, washed out roads and faulty alarm clocks.

The satellite system is based on a network of automatic battery-powered gages placed in remote areas, under bridges and other strategic locations. The gage batteries are charged by their own solar cell. Some situations are primarily telephonically monitored with the satellite serving as a secondary data transmission system.

One of the major advantages of the satellite system is its "stand alone" capability. Information is automatically transmitted through the satellite to the NOVA computer at WES, which district hydraulic engineers and technicians access to perform instant analysis. Though some local gage readers are still used, the 24-hour information flow and reliability of the satellite system, and the telephone access-satellite system have proven extremely effective in flood fighting.

At present, the district receives its satellite information from the NOVA computer at WES and manually loads it into the district's computer. Plans for system expansion, however, show computers that can compile information directly from the satellite.

Computer Modeling

Information entered into the district's computer is used to develop models for forecasting the rate of flow, rate of rise, and flood crest of streams and lakes in the Vickburg District. The computer modeling system can quickly assimilate such varied information as amount of rainfall (actual and predicted), runoff and river stages, and present it in a usable form.

A Winning Combination

Computer modeling and satellite gages have given the Corps a new advantage in fighting rampant rivers. During the December 1983 flood at Greenwood, MS, the rapidly rising Tallahatchie River threatened to overflow the Fort Pemberton Plug, a major item in the Greenwood protection works. Using satellite information and a computer model, hydraulics personnel were able to accurately forecast the rapidly rising river stages and allow necessary lead for the Greenwood office to successfully implement measures in protecting the plug.

The Corps' modern technology also benefits individuals and small business concerns. During a 1982 flood event, a Mississippi delta catfish farm, an industry highly susceptible to flooding, was threatened by rising water. The owner called the District Hydraulics Branch for information on flood levels.

Using data made available by local gage readers, and the satellite gage system, hydraulic engineers and technicians were able to monitor the river over a 24-hour period and to obtain an accurate prediction. Relying mainly on Corps data, the farmer elected to keep his catfish crop in place rather than undertaking the costly procedure of pond draining and premature harvesting. Accuracy of the forecast was within one-tenth foot and the farmer was spared considerable misery and expense.

Because of the reliability of Corps' information, many people request river information which is not forecasted by the National Weather Service, such as the Tensas and Boeuf Rivers in Louisiana. In many instances, the Vicksburg District offered timely forecasts which allowed people to protect their homes and belongings from flooding.

A resident of the Tensas Basin reported that the river was nearing her home and gave the approximate distance of the water from the house. Corps experts predicted that the water would only rise one inch above the house's slab. They also advised her that banking dirt against the house and covering it with plastic could help prevent the water from entering. By all reports, her efforts were a total success.

The accuracy and timeliness of satellite-aided computer forecasting allow businesses the time to evacuate inventories, ranchers to move cattle to higher ground, elevator operators to remove grain and machinery, and homeowners to protect their possessions.

Aerial Assistance

During a major floodfight, the Corps often needs a closer aerial view than that afforded by the satellite system. Helicopters and high altitude surveillance aircraft are used for these missions. During the May 1983 flood, the Vickburg District received aerial assistance from the U.S. Army Electronic Proving Ground at Fort Huachuca, AZ and from Detachment 3, 327th Aviation Group, 121st Army Reserve Command (ARCOM).

Meshing old tools and new technology, Fort Huachuca supplied an OVID-Mohawk Army reconnaissance surveillance platform equipped for false color photography, infrared photography, high-resolution panoramic photography, and side-looking airborne radar. The Mohawk is capable of flying 200 to 25,000 feet above ground level with a maximum speed of 200 knots.

The Mohawk was requested primarily for its airborne radar, which can delineate the flood's limits (where water meets land). The infrared linescan augmented the radar and was especially useful in detecting seepage or breaks in levees. High-resolution photographs were then compared with the

The OV-1D Mohawk was used to map the extent of flooding, locate seepage under levees, and survey the District for flood damage. (U.S. Army photo.)

infrared photographs to form a comprehensive image.

The OVID offered District experts a lofty vantage point to view flood damages, while helicopters from the 121st ARCOM provided for detailed inspections. Using OH58-A Kiowa four-seater helicopters and the larger UH1H Iroquois (Huey), the Corps maintained a close surveillance on hundreds of miles of levees and several flood control structures.

The helicopters were also used for aerial photography, assessing flood damages and endangered levees, and reaching areas inaccessible by ground transportation. This allowed Corps Engineers to cover vast areas in hours instead of the days it would have taken by land conveyance.

Lessons Learned

Although the new flood fighting technology has resulted in many lessons learned, one lesson particularly deserves more attention. The information provided by satellites, computer models, and aerial reconnaissance is only as good as the individual analyzing the data. Computer-aided forecasts are most useful when tempered by sound judgment based on practical experience with the rivers.

Often, a forecast based on computer results has been completely reversed because of human interpretation. An aerial photograph is useless unless the examiner is skilled in translating the visual images into useful data. Even with the timeliness and accuracy of information gathered through the new technology, human judgment remains the critical element in flood fighting. The people of the Vicksburg District succeed by applying sound judgments based on vast experience and using the latest technological advances to prevent as much loss and suffering as possible.

LTC Stephen E. Shepard is the Deputy District Engineer of the Vicksburg District. He is a graduate of the Command and General Staff College and has a bachelor's degree in commercial art and engineer management. He also has a master's degree in environmental management from the University of Texas. LTC Shepard previously served as the Readiness Advisor at Fort Sam Houston, the Resident Engineer in Saudi Arabia, and as Project Engineer in the Galveston District.

Hotline Q & A

Q. When disabling a bridge, on which side of the bridge should the Triple Nickle Forty charges be placed (the friendly, enemy or either)?
A. Reference FM 5-25, Chapter 4, section III. The charges are used only on abutments up to five feet thick. Complete demolition and partial demolition under various circumstances require different placement of charges. The Engineer school teaches that for complete destruction - place the "Triple Nickle Forty" charges on both the friendly and enemy sides and for partial destruction - place the charges on the friendly side. The use of charges depends on the target, the time, the commander's requirement and the rule from appropriate manuals.

Q. Smoke grenade launchers on AVLBS and CEVs do not fit properly w/out modification. What is the Engineers School doing to resolve this problem?
When the smoke grenade launchers were used over a year ago, mounting brackets were not issued. These brackets are necessary to install the grenade launchers onto CEVs and AVLBs. Mounting kits, however, are not expected to become available until 1985, and only depot maintenance is authorized to mount smoke grenade launchers on CEVs and AVLBs.

Q. I need to obtain some general purpose barbed tape obstacle (GPBTO) material for training purposes.
GPBTO can be requisitioned material through normal supply. The NSN is 5660-00-921-5516.

Battlefield Environmental Effects Software (BEES)

by Boyd Poush

A warrant officer, who is a terrain team leader, walks into an office and introduces himself to the person seated at the desk top computer keyboard.

"I saw the BEES demonstration during Gallant Knight, and I was impressed," he says. "Can you show me what else BEES can do?"

An hour later, he departs with 50 feet of computer printouts tucked under his arm. "This is just what we need in the field," he says. "I wish the data base covered the whole world."

Scenes like this are happening at the U.S. Army Engineer Topographic Laboratories (ETL) and at Army installations and laboratories where BEES (Battlefield Environmental Effects Software) is being demonstrated. BEES, a user-friendly computer program system, is designed to demonstrate environmental effects information available to commanders for planning and conducting military campaigns.

BEES was first demonstrated in 1983 at Fort Bragg, NC, in a training exercise called "Gallant Knight." BEES processed real-time and predicted weather by using information which the Air Force staff weather officer provided. It also processed environmental data provided by the terrain team.

BEES shows how environmental information supports the Corps of Engineers AirLand Battlefield Environment (ALBE) program and the Training and Doctrine Command Demonstration Planning Team. ALBE focuses research and development programs on the Army's realistic battlefield concerns. Under ALBE, both the Materiel Defense and Readiness Command and the Corps of Engineers laboratories are cooperating to create products for field demonstration.

BEES is expected to be incorporated into these demonstration projects. BEES itself is a cooperative project, adapting specialized subprograms developed by other organizations such as the Army Smoke and Aerosol Working Group, the Atmospheric Sciences Laboratory, the Construction Engineering Research Laboratory, and the Night Vision and ElectroOptics Laboratory.

But now, let us return to the team leader and the demonstration he received from ETL geographer Paul Bourget.

The warrant officer reads a computer printout of the BEES 20-program menu. He expresses interest in the Army Construction Engineering Research Laboratory's Military Engineering program. Bourget then "calls up" a list of military engineering functions. The visitor selects the Bridge Classification program which Bourget requests. The computer asks for span length and road width in feet. The visitor supplies the information, and Bourget enters it into the computer. When all the required information has been entered, the computer prints a number that corresponds to a military one-way or two-way load classification.

Next, the visitor chooses the Climatic Statistics and Narratives program. At the computer's direction, he selects a country, region and city from the list which the computer offered. Given a choice of seasons, the visitor selects spring. Immediately, the printer displays statistics in temperature precipitation, winds, obscurants and clouds.

When the visitor chooses the Surface Wind Climatology program from the menu, Bourget removes a 5 1/4-inch flexible disc from the computer and inserts another. Bourget states that each floppy disc is capable of storing 270,000 bytes of information. The Surface Wind Climatology disc, for example, holds 34,000 entries for 62 stations in five countries for 10 to 30 year periods. The desk top computer now used for BEES demonstrations has a built-in storage capacity of 572,000 bytes at 8 bits per byte.

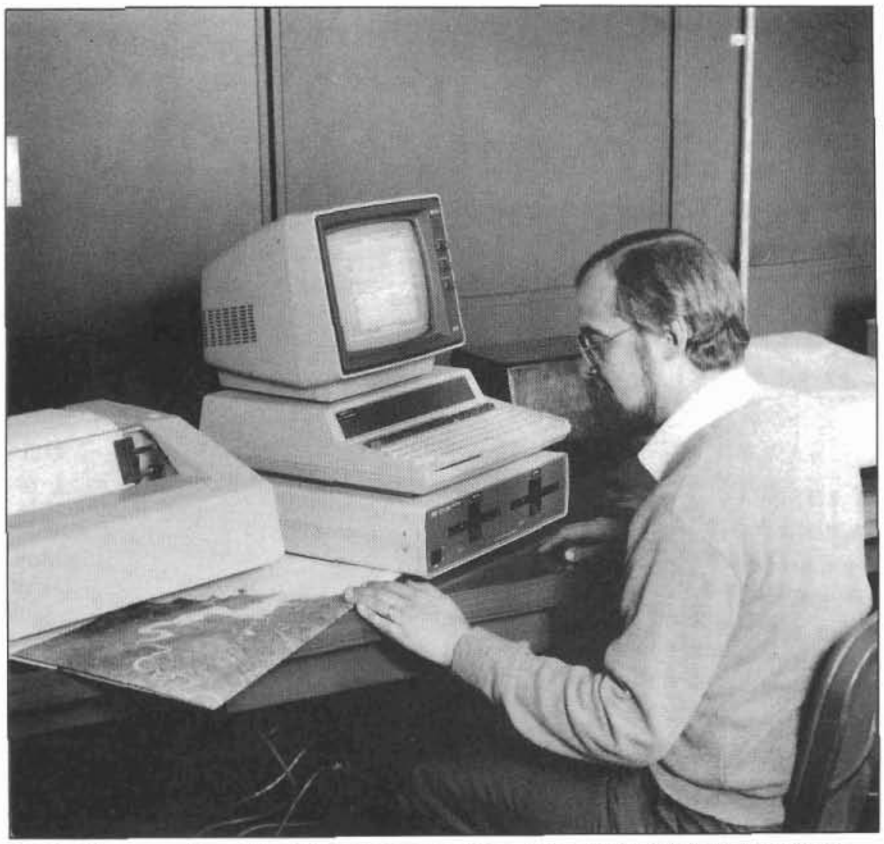
The overall BEES concept is not restricted to these specifications, however. Bourget explains that part of the BEES information is being translated into a computer language for the Army's MICROFIX microcomputer. Although terrain teams are among the units that will soon have MICROFIX systems, BEES programs are also slated to be included in ETL's Terrain Analyst Work Station (TAWS) and the Digital Topographic Support System (DTSS) computer programs.

After the new disc is inserted, the computer displays the Surface Wind Climatology program and gives instructions to choose from a list of countries. The terrain analyst chooses a country at random and then a city within that country. The computer gives surface wind averages in various speed categories at selected hours for each month based on data supplied by the Air Force Environmental Technical Applications Center.

The terrain analyst then turns to the very complex Real-Time Meteorological Data/Critical Values program. This program combines the weather forecast and terrain characteristics of a selected area and integrates the physical characteristics of various troops, operations and materiel. With this program, the computer can assist the commander in orchestrating the battle plan by evaluating the role that environmental factors will play in any given scenario.

Bourget enters the temperature, dew point and humidity into the computer. Then the computer asks for wind speed, direction, and altitude. (The computer can process such parameters as obscurants, precipitation, ceiling of visibility, and vegetation.) After Bourget enters all relevant data into the computer, it indicates the types of missions that are possible and the effects of weather and terrain on the commander's equipment and personnel.

In the Real-Time Critical Values program demonstration, tasks which are analyzed through the computer in seconds would take a terrain analyst hours or days—assuming he had access to the huge and varied source data. In a few minutes, the computer determines the environment's impact on such parts of the battle plan as: aviation; nuclear, biological, and chemical defenses; electrical equipment; incendiaries; materials; vehicles; aerial observation and photo reconnaissance; artillery operations; and engineering.



ETL Geographer Paul Krause studies map and BEES Classification graphic. (U.S. Army photo.)

Bourget explains that ETL's Battlefield Environmental Effects Group has been collecting worldwide climatological data since World War II and compacting it onto few magnetic discs. The computer produces answers in seconds, when a human terrain analyst would have to leaf through huge books of data and lengthy tables, and makes many complex calculations.

Now Bourget shifts to the Defense Mapping Agency Mobility Model program and requests a menu of U.S. and Soviet armored vehicles. The visitor chooses the Soviet T-62 tank. At the computer's bidding, the operator enters ground slope, vegetation type, stem diameters, stem spacing, and soil rating cone index. "Is considerable microrelief present? Shrubs . . . rocks? What is obstacle height? . . . Obstacle spacing?"

The computer asks for positive-negative slope changes (undulations). The average of six undulations per kilometer is entered. The computer answers that the off-road speed of the T-62 is six kilometers per hour in this terrain.

Now Bourget demonstrates the Paradrop Climatology program. After accepting ceiling height, visibility and wind speed, BEES quickly responds: Category 1, military free fall—not possible. Category 2, personnel and container delivery system G12—not possible. Category 3, equipment—not possible. Category 4, container delivery stem G13, G14—not possible. In other words, the combination of environmental factors exceeds the critical conditions under which any type of paradrop is possible.

The BEES computer is even programmed to spot operator errors. After Bourget enters arbitrary values to demonstrate a meteorological conversion, the computer first displays the instruction, "reenter data," and then displays the message, "the values are not realistic."

The demonstration ends here, but BEES has still more capabilities, including:

- Army Night Vision and Electro-Optics Laboratory Target Aquisition program
- Army Smoke and Aerosol Working Group Atmospheric Transmission model
- Density Altitude Climatology
- Army Atmospheric Sciences Laboratory KWIK Smoke Obscuration model
- Sunrise, sunset, twilight times
- Moonrise, moonset, moonphase
- Psychometric calculations

BEES is a fast-growing project. With its modular design, it can be quickly updated to include the best subprograms. Environmental effects have always had significant impact on combat. Now we have the means of quickly forecasting the effects for field commanders.

Boyd Poush is a public affairs specialist at U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA. He has a bachelor's degree in political science from George Washington University and formerly served as a foreign service information officer with the U.S. Information Agency in Indonesia and Yugoslavia. He also served as an aerial imagery interpreter in the U.S. Army.

The Need For The M9 Armored Combat Earthmover

by MAJ Donald T. Wynn and CPT Ronald G. Prichard

The M919 Armored Combat Earthmover (ACE), a significant improvement in earthmoving operations on the modern battlefield. (U.S. Army Photo.)

Improved weapon systems such as the Abrams tank, the Bradley fighting vehicle, and the Apache attack helicopter require support from associated systems of equal agility, mobility, and survivability. The M9 Armored Combat Earthmover (ACE) has these characteristics.

The evolution of the combat earthmover from World War II to the modern battlefield demonstrates the need for Engineers to provide rapid support in a hostile environment.

The bulldozer was growing in civilian importance when it was first used by the Army during World War II. It proved invaluable for clearing obstacles, breaching ditches, improving fords, filling craters, and increasing mobility.

But as Allied forces began using the bulldozers in combat, they found the operator and the vehicle needed armor protection. The bulldozer's immediate need in combat brought about dozer blades for tanks and armored cabs for bulldozers. The tank dozers were not as efficient or versatile as the armored bulldozers, so division commanders continued to use their bulldozers on the FEBA as much as possible.

Since World War II, the lethality of tank guns and artillery has increased tremendously. For example, a 1944 M4 Sherman tank required 13 rounds to achieve a 50 percent kill probability against a stationary target 1,500 meters away. A 1967 M60 tank required only one round to achieve a 50 percent kill probability. Today, the M1 Abrams tank has an even higher kill probability. The Warsaw Pact developed their weapon systems to a comparable level.

Lethality was also increased by new antitank weapons, such as the TOW and SAGGER. This lethality emphasizes the importance of a combined arms team approach and the necessity of using "hull down" positions whenever possible to protect weapon systems.

The 1973 Yom Kippur War and the current Iraq-Iran War have demonstrated this increased lethality as well as the necessity of prepared fighting positions. The importance of survivability and the value of bulldozers were proven during these wars. In fact, bulldozers were regarded as significant indicators of combat effectiveness. In the recent incursion into Lebanon, the Israeli Army found the capabilities of the armored bulldozers so essential that they led armored columns into the Bekka Valley. This surely demonstrates that a continuing and present need for an armored combat earthmover exists.

Mechanized armies throughout the world have recognized this need. The Soviets, French, Germans, British, Spanish, and Japanese have fielded new combat earthmoving equipment within the past few years. The Soviets, especially, have fielded systems solely devoted to earthmoving on the battlefield. These new systems are tactically mobile and designed to operate in the forward modern battlefield.

The U.S. Army has also expressed its needs for a mobile combat earthmover through the 1981 Engineer System Program Review (SPR), the Army 86 Study, and the Engineering and Mine Warfare Mission Area Analysis (MAA). These studies concluded that this needed earthmover must act as a combat multiplier. It must improve the survivability of combat systems and reinforce the terrain to preserve the movement of friendly forces and impede the movement of enemy forces.

The MAA provided a detailed analysis of Engineer missions in an AirLand Battle to support the combined arms team against the 1992 threat (Figure 1). The MAA study emphasized that these Engineer tasks must be performed in stride and under fire.

Besides the analysis of Engineer missions and task requirements, the MAA analyzed the Engineers' capability to deploy, to move, and to survive on the AirLand Battlefield as they perform their mission (Figure 2).

No single vehicle can perform all types of earthmoving tasks or move in support of the combined arms team (Figure 3). In fact, the Combat Engineer Vehicle (CEV) is the only Engineer vehicle sufficiently mobile and survivable to operate in the forward battle zone. However, it does not possess the required earthmoving capability—a major deficiency.

The M9 Armored Combat Earthmover (ACE) is specifically designed to eliminate this deficiency and provide the combined arms team with a highly mobile, survivable, earthmoving capability in the forward combat zone.

The M9 has the earthmoving capability to perform all the tasks

EARTHMOVING MISSIONS AND TASKS

Mobility Tasks

- **Combat roads and trails**
- **Forward aviation (helipads, forward arming and refueling points, airstrips)**

Counterobstacle Tasks

- **Tank ditch breaching**
- **Gap crossing (preparing sites)**

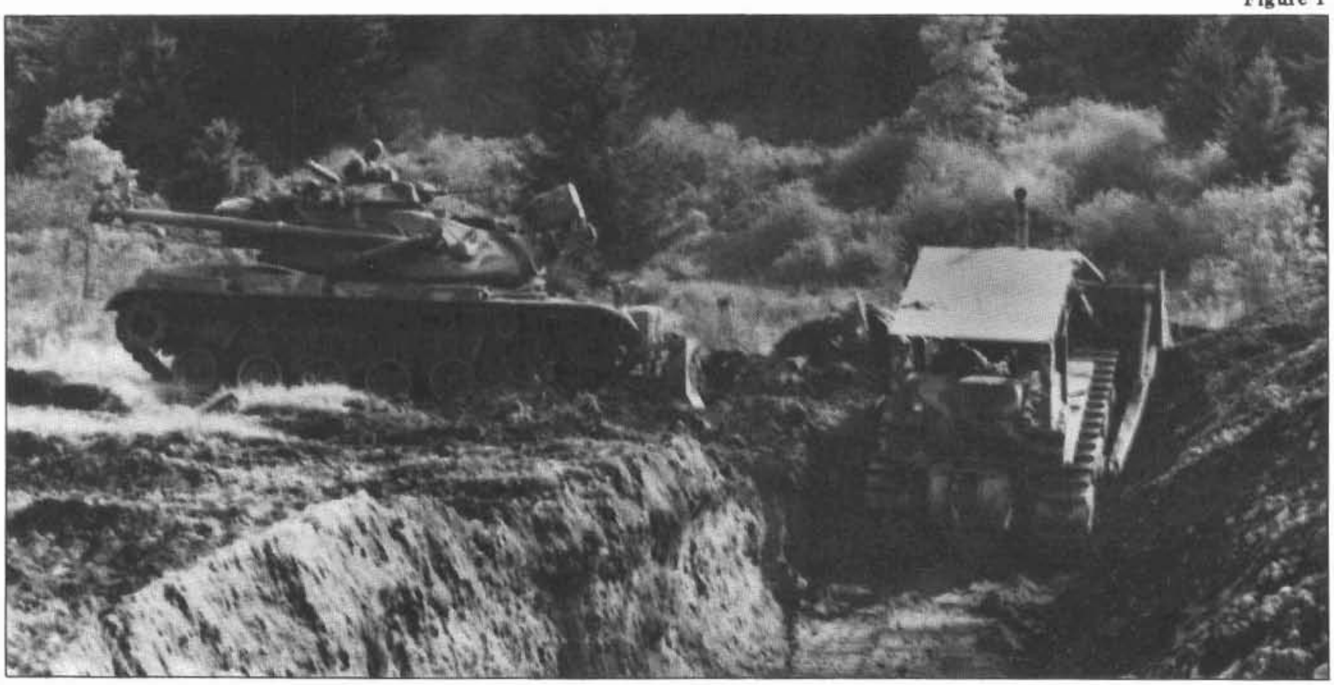
Countermobility Tasks

- **Obstacle development (digging tank ditches, cutting roads)**

Survivability Tasks

- **Fighting positions (excavating positions, fields of fire)**
- **Protective emplacements (hull defilade positions, command posts, fields of fire)**
- **Protected support facilities (protective berms)**

Figure 1



The ACE will greatly increase Engineers' earthmoving capabilities over the D7 dozer and the Combat Engineer Vehicle (CEV). (U.S. Army Photo.)

The ACE shows its increased mobility capabilities for Engineers in the AirLand Battle. (U.S. Army photo.)

needed in the forward areas. In addition to many other tasks, the M9 can:

- excavate fighting positions
- clear fields of fire
- cut combat roads and trails
- breach antitank ditches
- dig antitank ditches
- prepare river-crossing access and egress

At the same time the M9 has the characteristics which allow it to survive and move with the combined arms team in the forward combat zone.

- It is armored against indirect artillery and small arms fire.
- It has a smoke screening capability against direct fire weapons.
- It is air transportable in the C-130, C-141, and C-5.
- It provides NBC protection to the operator.
- It is tactically mobile with speeds up to 30 mph.
- It is amphibious.
- It can communicate with the task force.
- It has a night vision capability.

In addition to these characteristics, the M9 is operationally more effective than the D7 dozer it replaces (Figure 3). This advantage was demonstrated in an operational effectiveness study conducted in 1980 by the Engineer School.

The study scenario placed a U.S. battalion-size task force conducting defensive operations against a Warsaw Pact motorized tank regiment. The U.S. defensive operations culminated with a counterattack to reoccupy its initial battle positions before the arrival of the second threat echelon. The U.S. task force was supported first by two M9s and then, in an identical scenario, by two D7s. In comparison to the D7 support, the task force supported by the M9s: increased average task force movement rate by 67.7 percent; improved loss exchange ration by 22.44 percent; reduced weapon systems losses by 22.45 percent; and reduced M1 losses by 32.35 percent

DESIRED EQUIPMENT CHARACTERISTICS

Deployability

Air transportable (C-130, C-141, C-5)

Tactical Mobility

Highly Mobile (moves with maneuver forces)

Amphibious

Night vision

On-board communications

Battlefield Survivability

Armored (survives on lethal battlefield against indirect fire and small arms)

Smoke screening capability

NBC protection

Figure 2

PRESENT EARTHMOVING CAPABILITIES

Vehicle	Battlefield Use: Mobility Tasks	Battlefield Use: Counter-Obstacle Tasks	Battlefield Use: Survivability Tasks	System Characteristics: Tactical Mobile	System Characteristics: Able To Survive	System Characteristics: Air Deployable
Backhoe	No	No	Yes	No	No	Yes
Bucket Loader	No	No	Yes	No	No	Yes
Grader	Yes	No	No	No	No	Yes
D-7 W/ Tractor-Trailer	Yes	Yes	Yes	No	No	Limited
CEV	Limited	No	Limited	Yes	Yes	Limited
Proposed Capability						
M9 ACE	Yes	Yes	Yes	Yes	Yes	Yes

Figure 3

over the task force equipped with D7s.

A sensitivity analysis was also conducted in which the total number of D7s was increased to seven, the number necessary to dig-in the entire task force on its initial battle position. The force equipped with seven D7s was then tested against a force still equipped with only two M9s. The task force supported by the M9s: increased average task force movement rate by 67.7 percent; improved loss exchange ratio by 9.5 percent; reduced weapon systems losses by 9.5 percent; and reduced M1 losses by 20.7 percent; over the task force equipped with D7s.

The M9s performed better because they were more mobile and survivable on the battlefield. These characteristics, coupled with an impressive earthmoving capability, are desperately needed in the forward battle area.

Fortunately, the M9 is now in initial production. It will undergo final production tests before full production award in late fiscal year 1984. The Army will start receiving the vehicles in early 1986. With the fielding of the M9, the Engineers will have the capability to fully support the combined arms team on the modern battlefield.

One if the ACE's many capabilities is dumping with its 2 1/2-cubic yard bucket. (U.S. Army photo.)

MAJ Donald T. Wynn is the M9 Project Officer in the Directorate of Combat Developments at the U.S. Army Engineer School. He is a 1971 graduate of the U.S. Military Academy and a 1983 graduate of the Command and General Staff College. He has masters' degrees in applied science and business administration. He is a registered professional engineer in Virginia.

CPT Ronald G. Prichard is Commander, B Company 1st Bn (AIT) at Fort Belvoir. He served as platoon leader and executive officer in the 5th Engineer Bn. (Corps) (Cbt) at Fort Leonard Wood and was a project officer with the Directorate of Combat Developments. CPT Prichard is a graduate of from the U.S. Military Academy, and masters' degrees in engineering management and American history from the University of Missouri-Rolla and George Mason University.

A battalion staff briefs their commander on Engineer operations. (U.S. Army photo.)

Engineer Modeling Program

by Burnham S. Gould, Jr. and CPT James V. Mudd

Combat Simulation Models Show Importance of Engineers in Fighting Airland Battle

Would you believe that the United States Army is constantly fighting on such a vast scale that it could afford to experiment with many different hardware configurations, doctrines and organizations? Well, believe it! The Army is fighting on such a scale—that is, in the form of combat simulation models.

Without actual battlefield results, the effect of alternative hardware configurations, doctrines and organizations cannot be verified. They must be predicted on some other basis such as military judgment or sound logic.

The Army finds combat simulation models to be especially helpful in making these predictions. When used properly, these models combine the advantages of hard data of experimentally tested factors (such as weapon system accuracy, lethality and vulnerability) with military judgment and mathematical logic.

Results from combat models are crucial to the Army's decision-making process. They influence the decisions effecting which hardware programs receive funds as well as influencing the size and composition of forces and battlefield tactics and doctrine employed. The reliability of these decisions, however, depends on the quality of the combat models used.

The Directorate of Combat Developments (DCD) at the Engineer School wants Engineers to be realistically portrayed in the combat models used in Army studies. This realist approach helps to ensure the Engineers' role as members of the combined arms team is properly reflected in funding decisions.

The analysis branch of DCD, for example, reviews major studies conducted throughout the Army. It is especially concerned with the quality of Engineer representation in the combat models used. While the Training and Doctrine Command (TRADOC) uses 43 officially approved models, of which 12 are used for force-on-force combat analysis, the Engineer School must be knowledgeable in all of them.

A family of models being developed under the Army Model Improvement Program (AMIP) is especially important. The Army intends the AMIP to form the basis of all major combat modeling. When completed, it will comprise a new generation of combat models.

The AMIP is a hierarchy of three models sequentially named from small units (highly detailed) to large units (highly aggregated); for example: the Combined Army Support and Task Force Evaluation Model (CASTFOREM); the Corps/Division Evaluation Model (CORDIVEM); and the Force Evaluation Model (FORCEM). (Figure 1 shows the relationship between these models.)

The underlying concept in the system is that combat results will flow from lower level models to higher level models, and scenarios will flow from higher level models to lower level models. Engineer School guidance must ensure that the logical relationships between the models are valid, and that the Engineer functions represented in each model are relevant to the context of the whole hierarchy.

CASTFOREM, a model developed by the TRADOC Systems Analysis Activity (TRASANA) is one model which is near completion. Engineer representation includes close combat activities such as minefield emplacement and breaching, individual items of equipment and weapon systems. TRASANA and the USAES have begun a joint study to debug the Engineer portion of this model and to investigate new Engineer system alternatives.

CORDIVEM, a model developed under Combined Arms Operations Research Activity (CAORA) direction is undergoing testing. The Engineer module in CORDIVEM was developed by the Construction Engineering Research Laboratory (CERL) under the Engineer School's guidance. This module includes a precise method for allocating Engineer resources. Procedures are being developed to better represent Engineer attrition, resource constraints and movement.

FORCEM, a model being developed by the Concepts Analysis Agency (CAA), is in its early stage. Engineer representation will be res-

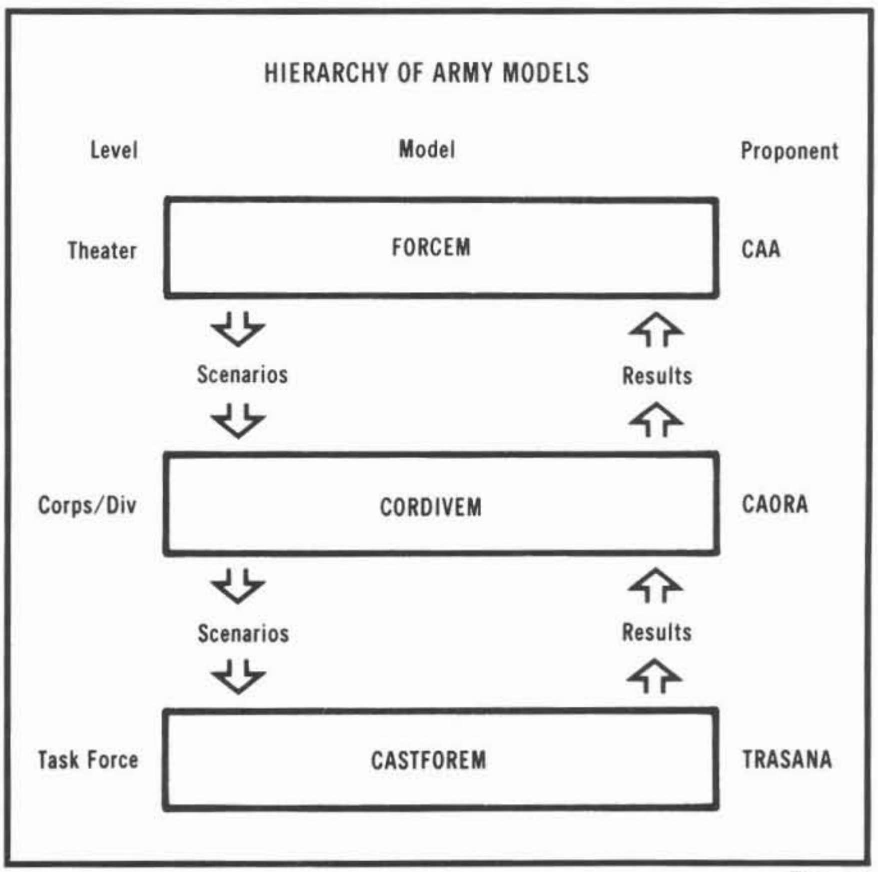


Figure 1

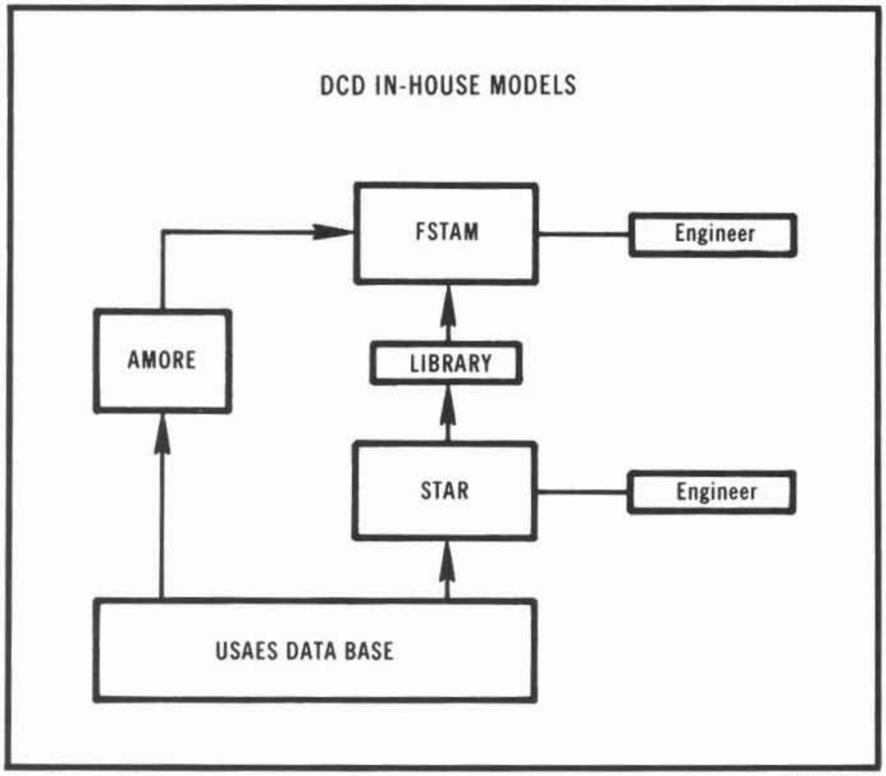


Figure 2

tricted to those activities occurring behind the division rear boundary. CERL is also developing an Engineer module under the Engineer School's guidance to allocate Engineer assets to tasks in priority. This pilot module already has been successfully tested.

Although the models described are extremely important, they are primarily used by the large analytical agencies, such as TRASANA, CAORA, and CAA. However, they are not available to most field analytical cells, such as the Analysis Branch of DCD. This means that DCD must develop its own modeling capability in order to perform quality studies for the Engineer School. Such studies include cost and operational effectiveness of hardware systems, mobility, mission area and functional area of mobility, countermobility and survivability missions, and organizational effectiveness.

Currently, in-house modeling capability is represented by a high resolution analytic model, the Simulation of Tactical Alternative Responses (STAR) Combat Model, and a force design methodology, the Analysis of Military Organizational Effectiveness (AMORE). A Force Structure Trade-Off Analysis Model (FSTAM), where Engineer force contributions can be directly analyzed, is also planned. (Figure 2 shows the relationship between these models.)

The STAR combat model can simulate brigade versus division conflicts. This model has an Engineer module that simulates the effects of minefields and other obstacles on the combined arms battlefield. In August 1982, a memorandum of agreement was signed for the use of the Night Vision and Electro-Optics Laboratory computer facility to use STAR. Since then the STAR combat model has been used to measure the combat effectiveness of several proposed countermine systems. The results were reported in cost and operational effectiveness analysis studies and are being published in Required Operational Capabilities (ROC).

AMORE is a methodology with an associated computer model developed by Science Applications Incorporated (SAI). The Engineer School began using methodology in January 1983 on the School's IBM computer. It provides the ability to measure a unit's robustness, which is defined as resiliency and redundancy. Output from the model shows details of a unit's capability after a period of degradation, such as the loss or overuse of mission-critical equipment and personnel. TRADOC directed that the AMORE be used to analyze all new organizational designs and major organizational changes.

FSTAM will be a theater level mode that assigns Engineers to particular jobs within an operational area. This model will give the USAES the ability to directly measure the contributions of the Engineer force on the battlefield. Presently, the most feasible candidate for this model is the Joint Theater Level Simulation (JTLS).

JTLS, developed for the Readiness Command, the Army War College, and the Concepts Analysis Agency by the Jet Propulsion Laboratory, is a highly aggregated computer-assisted war game which simulates conflicts between forces to theater size strength. (Unit resolution is normally battalion level.) The Engineer portion of this model will be augmented by the integration of an Engineer module already developed by CERL.

Although this was a brief introduction to an extremely important complex and frequently misunderstood subject, the Engineer School's work with the Engineer modeling program may place Engineers ahead of the rest of the Army. This enables the Engineer community to make its needs better understood when decisions to allocate resources (for the AirLand Battle) are made.

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Captain James V. Mudd is assigned to the Directorate of Combat Developments, Fort Belvoir. He is a graduate of the United States Military Academy, the Armor Officer Basic Course, and the Engineer Officer Advanced Course. CPT Mudd has a master's degree in operations research from the Naval Postgraduate School. He is a registered professional engineer in Virginia.

Automated Construction Management System

by Charles E. Herring

Combat Engineers of the 18th Engineer Brigade have found managing construction programs easier with the help of a microcomputer system called the Automated Construction Management System (ACMS).

ACMS is part of a pilot research study aimed at exploring microcomputer applications for Combat Engineers. Using off-the-shelf hardware and software, the U.S. Army Construction Research Laboratory (USA-CERL) was able to minimize programming and concentrate on developing system applications.

To test the ACMS, construction and financial managers at headquarters, 18th Engineer Brigade in Germany, are using the system to manage the Grafenwoehr Training Range upgrade project—the largest construction effort in Europe, consisting of more than 120 individual projects.

The ACMS enables the user to maintain current records on costs of construction projects. For example, touching a button may display the names of individuals responsible for various construction tasks. Another button may show the tasks which have been completed and when they were completed. The ACMS also speeds the report writing process by compiling data and printing several reports, summarizing the status of construction projects.

According to MAJ Russell P. Baldwin, 18th Engineer Brigade S-3, implementing ACMS was relatively easy. Two clerk-typists assigned to brigade headquarters were trained on-the-job and no formal classroom training was necessary.

The system, itself, consists of five integrated modules. Access to the application modules is provided by a menu program called SUPERVYZ. The menu presents a list of options from which the user can choose. A menu option may lead to a menu of another module or it may be used to initiate action on a specific function such as "generate reports." The menu system forms a tree structure that is shown in Figure 1. By typing "?" on the keyboard after the menu is displayed on the screen, the user is provided with online help which explains what each menu option does.

Network Analysis Module

The network analysis module will help users track the completion status and scheduling of construction tasks. The module consists of: a powerful Critical Path Method (CPM) program called PMS-11; help files; and utilities for copying and deleting files and for checking file status.

Each project officer develops a network and completes a CPM Input Form. This information is entered into the CPM program which calculates the critical path and generates the following reports: a detailed activity listing; an activity-on-arrow network logic diagram; and a Gantt bar chart (Figure 2). After examining the output, the project officer can perform "what if" analyses by making changes to the network and examining the new results.

Because the ACMS is automated, changes to a CPM are made easily. As work progresses, the actual start and finish dates of the activities may be entered and the updated CPM network generated. In addition, a library of CPMs can be stored for later use in planning to serve as a reference source for project officers.

A summary Construction Status Report is then generated to show the scheduled and actual percent complete, allocated and expended funds, and percent funds expended for each group.

A Monthly Contractor and Troop Construction Report is printed for each battalion and shows the monthly physical and financial progress for each task assigned to that battalion. The Customer Billing Report is produced weekly and lists the allocated funds, costs to date, previous cumulative billing, billing for the current period, and the balance for all projects funded on each construction directive.

The design of ACMS reports are patterned after currently-used Engineering reports. According to MAJ Baldwin, ACMS reports have replaced 99 percent of the reports once prepared manually at the brigade level.

General Application Module

The General Applications Module provides users with two valuable software programs and additional utility menus. First, WordStar, a popular word processing program, can be used for any correspondence

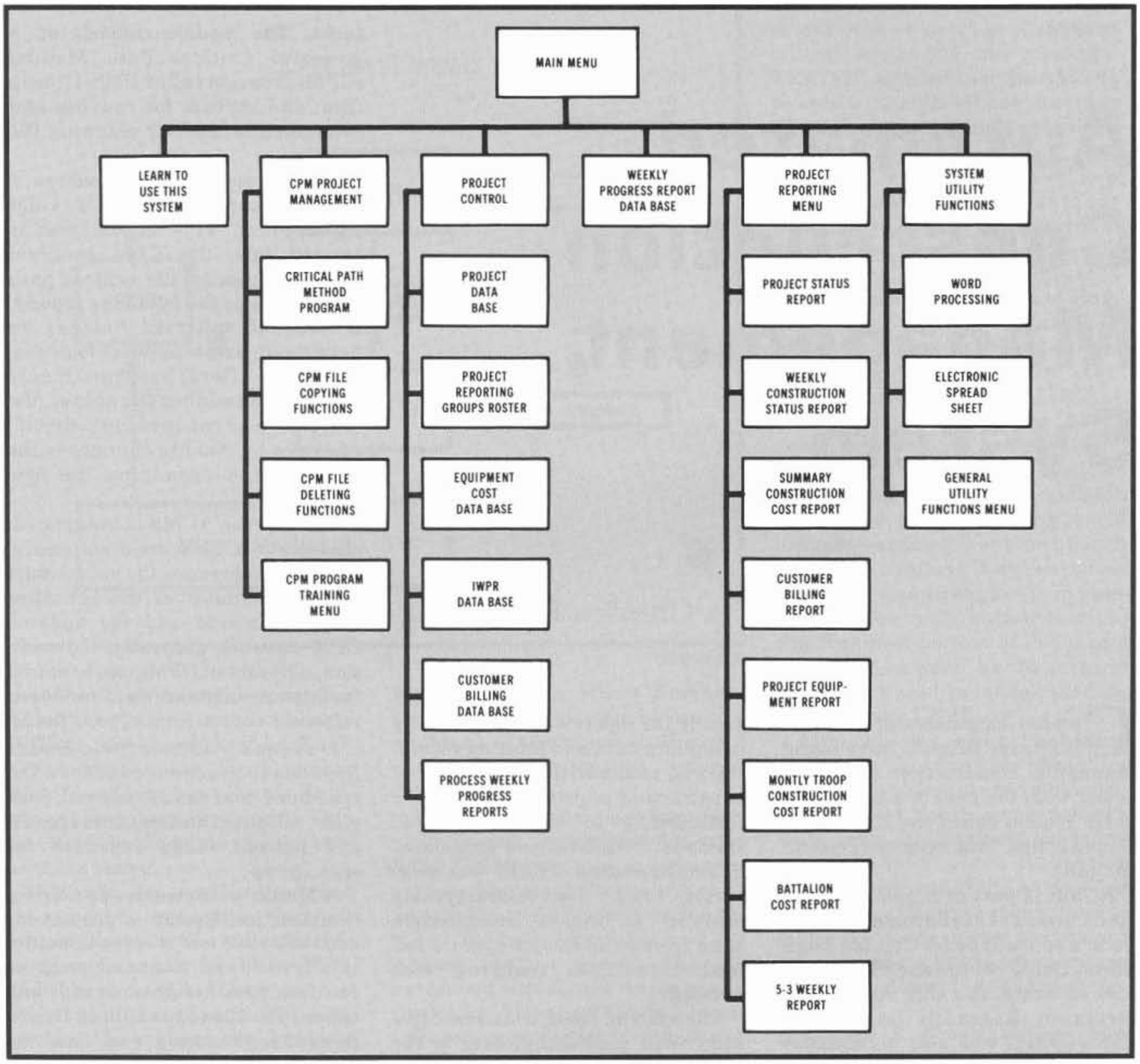


Figure 1. ACMS menu system flow diagram

associated with construction management. In addition, units without word processing capabilities will have these programs and menus with ACMS.

Second, SuperCalc, an electronic spreadsheet software program, performs any calculations not already programmed into ACMS. Users can also use SuperCalc to keep track of how funds are being allocated within a project.

And third, additional utility menus maintain and duplicate data bases and perform system diagnostics. All of the software systems use current data already stored in the ACMS, making record keeping easier and more accurate.

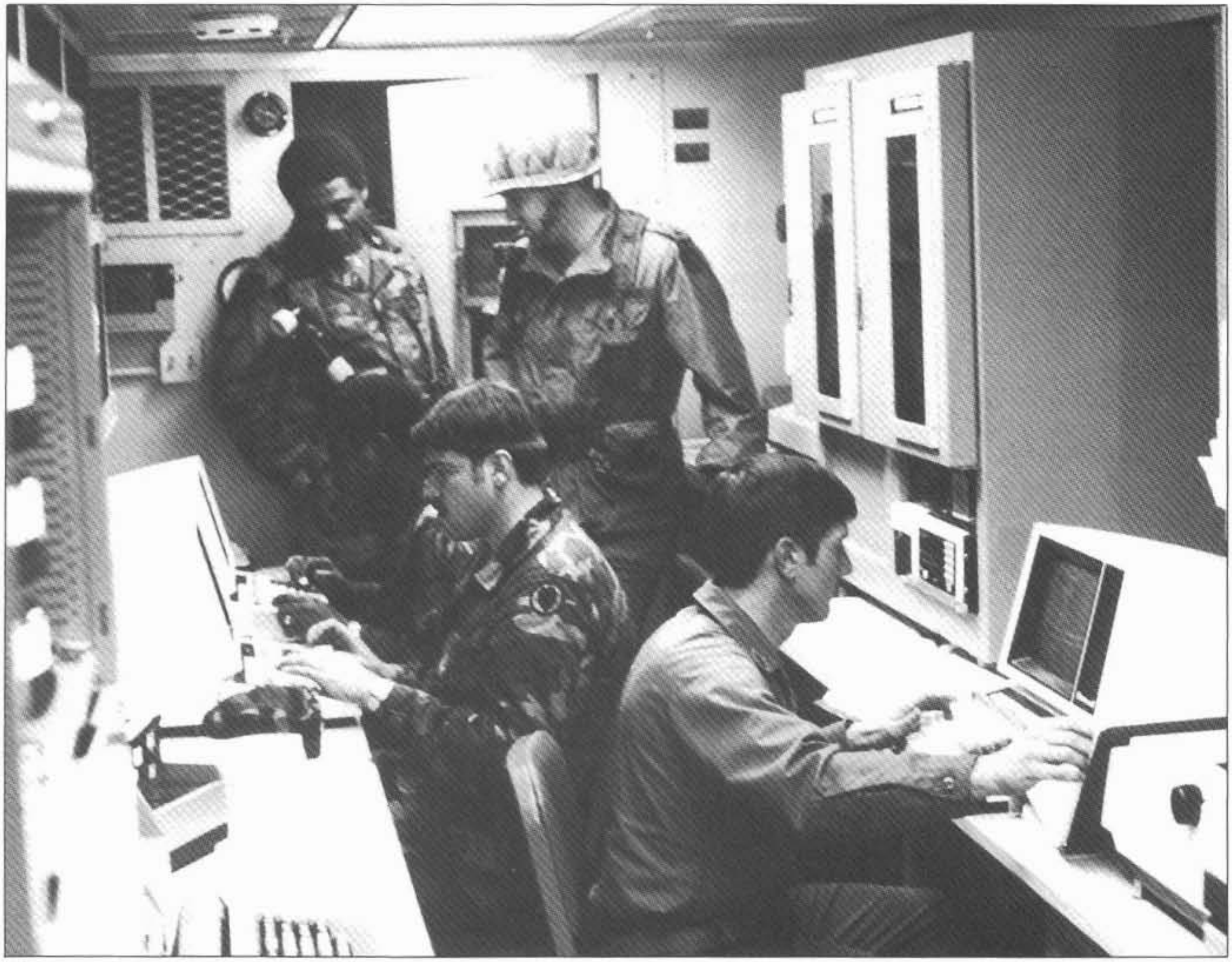
Advantage of ACMS

Maj Baldwin says that users of the ACXMS at the 18th Brigade have reacted favorably to the system. He adds that personnel at the 18th Engineer Brigade have found that the ACMS helps in three ways.

First, the ACMS significantly reduces the tediousness of the report preparation process. Project officers only have to record raw data on the word processor; the computer performs the vast majority of calculations. This enables construction managers to spend more time in the field supervising their projects.

Second, the ACMS makes it much easier for personnel to keep accurate records. After project information changes are entered into the computer the new information is immediately disseminated to other users. Entering new information will automatically update other reporting files.

Third, the ACMS quickly produces valuable summary reports from a large volume of data. Managers now have more control over their projects because summary reports are generated faster. These reports enable a manager to review phases of the project during construction or the entire project after completion. In addition, the ACMS can provide a statistical analysis of construction efficiency for an activity. Con-



The DAS3 van-mounted data processing system allows better control of equipment, spare parts, and maintenance records. (Photo courtesy of Tactical Data Systems, General Electric.)

sequently, managers can make better decisions because they are better informed.

Project Control Module

The remainder of the modules, with the exception of the General Applications Module, were written by USA-CERL using Base-II, a data base management program.

The Project Control Module has four data bases. The project data base stores project information such as construction directive number, project location, constructing unit, estimated cost, allocated funds, and TDY rates. Default TDY rates or rates specific to a particular location may be used. Project data (which is used for producing a variety of reports) may be entered, changed, or deleted.

The Equipment Cost Data Base can record costs for approximately 350 individual line items. Data submitted by the project officer is used to calculate equipment costs charged against individual projects. The 18th Engineer Brigade uses this data base to keep track of the actual equipment hours for over 300 pieces of equipment.

The Customer Billing Data Base is used to produce reports for projects funded under a construction directive. These reports place monetary values on all work completed on these projects. The 18th Engineer Brigade uses the Customer Billing Data Base to summarize the costs of the 120 projects at Grafenwoehr by assigning projects to construction directive numbers. Consequently, the brigade's staff and the brigade's major customer, the 7th Army Training Command, receive an accurate summary of weekly costs.

The Project Groups Data Base is used to define groups of projects for summary reports. For example, the Engineers in the 18th Brigade define project groups according to both the battalions responsible for the projects, and to the firing range in which they are located. This provides flexibility in generating summary reports. All of the battalion's projects for a specific range, or Facility Engineer projects of a certain type or location, can be specified as being part of a particular group for reporting purposes.

Weekly Progress Reporting Module

The Weekly Progress Report (WPR) is the key source data document for project tracking and billing. Each week the project officer submits a WPR to 18th Brigade headquarters. The WPR contains

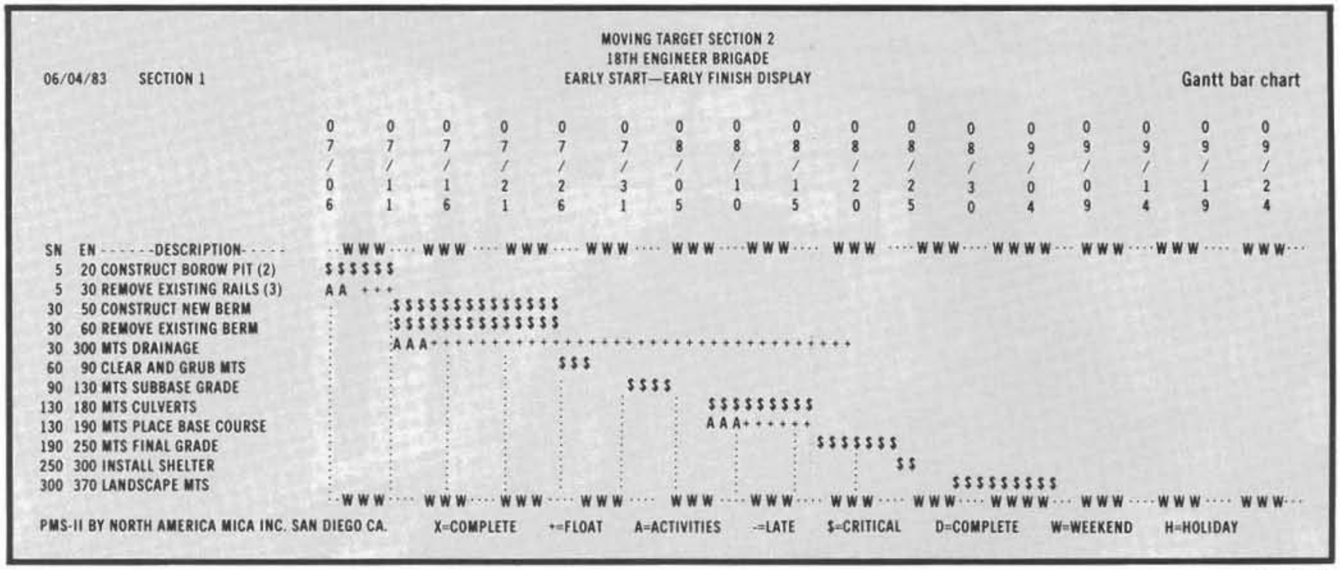


Figure 6

information on TDY charges, manhours worked on each activity, and equipment usage. This data is entered into the Weekly Progress Report Data Base. The system performs all required calculations and stores cumulative data for each task. This data is used by the Reports Generation Module to generate summary reports.

Reports Generation Module

This module produces six reports using information provided in the Weekly Progress Reports. A Project Status Report is printed for each active project, showing the current physical progress, cumulative manpower use figures, and financial progress. A copy of this report is sent to the project officer.

The other reports are summary reports for management use. A Weekly Construction Status Report may be produced for each group of projects. The report lists the title, unit, start and completion dates, scheduled and actual percent complete, percent funds expended, and number of days ahead or behind on the critical path for each project.

Future of ACMS

Even though the ACMS was designed for the 18th Engineer Brigade, its modules can be modified to meet other organization's specific needs. The construction management process used in the modules is typical of most Combat Engineer units. Parts of ACMS are being used by the 2nd Engineer Group, Korea; the 20th Engineer Brigade, Fort Bragg; and the 416th Engineer Command, Chicago, IL.

In May 1984, USA-CERL began the development of a "Mission Management System (MMS)" as an interim system to a "Combat Engineer Command and Control System (CECCS)." A generic version of ACMS, applicable to all Engineer units, will be developed as a part of MMS. Some pilot modules of MMS will be field-tested starting in the fall of 1984.

USA-CERL has been tasked to assist the US Army Engineer School (USAES) in developing a command and control system for Combat Engineers. Work on that system will begin in FY85. ACMS version 84.0 is available from the Command and Control Microcomputer User's Group (C^2MUG). Contact: Chief, CECOM SDSD, ATTN: DRSEL-FL-SDSD (C^2MUG), Fort Leavenworth, KS 66027. Telephone (913) 684-7550, or AV 552-7550.

Mr. Charles Herring is a programmer/analyst in the Microcomputer and Simulation Team at the U.S. Army Construction Engineering Research Laboratory in Champaign, IL. Herring has a bachelor's degree in physics from the University of Mississippi and is working toward a master's degree in computer science at the University of Illinois at Urbana-Champaign. His research at CERL has been in the areas of microcomputer applications, military engineering, and office automation.

Herring is a first lieutenant in the Army Reserves and graduated from the Engineer Officer's Basic Course at Fort Belvoir in May 1981.

ENGINEER HOTLINE

Problems, questions, and comments relating to engineer doctrine, training, organization, and equipment can be addressed telephonically to the U.S. Army Engineer School's "Engineer Hotline". The Hotline's auto-answer recorder operates 24 hours a day, seven days a week. Callers should state their name, address and telephone number, followed by a concise question or comment. You'll receive a reply within three to 15 days. **The Hotline is not a receiving agency for formal requests.**

Call commercial (703) 664-3646; WATTS 800-336-3095, extension 3646; or AV 354-3646.

MODERNIZATION OF COMBAT CONSTRUCTION EQUIPMENT

by CW3 Ben Fenhagen

Heavy road grader

As a result of the Airborne Airmobile Program and the Commercial Construction Equipment (CCE) Standardization Program, efforts are underway to reduce the number of different makes and models of construction equipment used by the U.S. Army Corps of Engineers.

In the past, the Army's Engineer construction equipment was purchased commercially. Today, many of those items are old, obsolete and logistically unsupportable. To further aggravate the problem, many identical items used by Engineers are available in several makes and models.

One active duty division, for example, has six similar scoop loaders from three manufacturers, four graders from two manufacturers, and five model compressors from two manufacturers. This diversity in construction equipment adversely affects unit readiness by placing additional strain and burden on the logistical support and training base within the Army. The Army, though, recognizes the problem and is moving toward standardizing construction equipment.

Initially, the FAMECE (Family of Military Engineer Construction Equipment) program, a strategy which evolved in the early 1970s, was considered the solution for achieving standardization. FAMECE was an "all purpose" piece of equipment using a common power unit with a variety of earthworking attachments. But after nearly a decade of development and testing, the program was terminated for insufficient funds.

Since 1972 and throughout the full-scale development phase of FAMECE, virtually no funds were committed to buying conventional equipment which was expected to be replaced by the FAMECE. This funding void contributed to the existing construction equipment problem in the Engineer inventory.

After FAMECE was cancelled, the Engineer School analyzed the overall status of combat construction equipment and determined that the need to replace equipment in the airborne and airmobile forces was evident. Major pieces of construction equipment, including loaders, graders, compressors and tractor-towed scrapers, exhibited the worst posture mainly because of overuse, aging and diversity of makes and models.

The analysis also served as a basis for creating two major modernization efforts: the Airborne/Airmobile Program and the CCE Standardization Program. Much of the airborne and airmobile equipment was old at the beginning of FAMECE. BY 1979, many of these items were logistically unsupportable and were degrading unit readiness.

In a joint effort, the Engineer Corps identified the most critical items. These items now comprise the Airborne/Airmobile Program, which consists of loaders, graders, scrapers, water distributors and two sizes of crawler tractors. Contracts for both airborne and airmobile versions were approved in fiscal year 1982. The equipment (conventional commercial items) was altered to meet unique air transportability requirements.

Aside from obvious logistical advantages of new equipment, the program offers additional benefits. It replaces some wheeled tractor-towed scrapers with a modern, self-propelled, elevating scraper. This scraper can be air delivered in a single air drop package or transported in two sorties by a helicopter. Existing scrapers require two air drop packages and possibly five sorties for helicopter transport. In addition, a new increased capacity (2500-gallon) self-propelled water distributor will replace the 900-gallon water bladder, which is generally mounted on a 2 1/2-ton cargo vehicle. Other new features include angle blades for the crawler-tractors and articulated frame steer graders. Both will increase equipment flexibility and productivity.

Still the standardization problem remained unsolved. This significant weakness prompted a DA effort to establish a CCE Standardization Program. This program follows the Airborne/Airmobile Program and is part of a longer term modernization effort.

Since analysis again indicated the need to completely replace key items, it was necessary to list these items by certain limiting factors and by funding constraints imposed by the Army. Some of these factors were mission essentiality, equipment age, density, number of models fielded and logistic supportability. Subsequently, the priority list was used to influence funding. TRADOC and DARCOM developed technical data packages to support procurements scheduled to begin by the middle of the 1980s.

The resulting CCE program basically became a procurement strategy involving competitive multiyear procurements as the key element in achieving standardization. This approach will reduce the number of different makes and models of equipment and reduce the increased logistic burden of documenting, provisioning and training.

With contracts recently approved for the four highest priority items (loaders, graders, scrapers and air compressors), the CCE Standardization program is now a reality. The contracts, awarded to J. I. Case Company, Caterpillar Tractor Company and Ingersoll-Rand in January and March of 1983, represent orders exceeding 7,000 pieces of equipment through 1986. The equipment under contract is basically from the manufacturer's commercial product line with modifications to meet military unique requirements (for example, blackout lights, slave receptacles and lifting lugs and tiedowns).

One of these new contracts includes a wheeled loader contract, awarded to the J. I. Case Company, for the MW24CIS powered by the Case A504BD diesel engine rated at 132 horsepower. It is equipped with a 2 1/2-cubic yard multipurpose bucket and will replace several models of like loaders.

Caterpillar Tractor Company was awarded contracts for the graders and tractor-scrapers. The new graders, the CAT 130G model powered by the CAT 3304 diesel engine, feature articulated frame steering, which provides greater operator control and flexibility on the job sites. The scraper selected is the 621B self-propelled tractor-scraper. It has a 14-cubic yard struck and 20-cubic yard heaped capacity powered by the CAT 3406 diesel engine. The tractor-scraper will replace existing wheeled tractors and towed scrapers.

New trailer-mounted 250 CFM air compressors were contracted to Ingersoll-Rand. The contract includes complete pneumatic tool and compressor outfits and separate trailer-mounted 250 CFM air compressors. Field units scheduled to receive separate trailer-mounted 250 CFM air compressors, but already having complete outfits, will transfer their tools to the new trailer and turn in the old trailer and compressor. Complete outfits are being purchased to fill existing shortages. The new compressor will be a rotary screw type, powered by a Deutz air-cooled diesel engine.

Each of the new items possesses

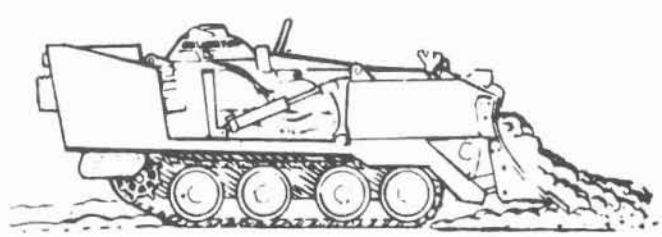
14-cubic yard scraper

impressive credentials. Initial fielding of the contracted items will begin by late 1984. Additional items planned for the multiyear procurement under the CCE Standardization Program include the following: the small emplacement excavator, the T-9 size dozer and the 7 1/2 and 20-ton cranes.

The CCE Standardization Program is a significant achievement in modernizing the total force. Tangible benefits in training and overall logistic support will be evident in future years. The true benefit, however, will be in improved readiness and capability of Engineers to carry out their role in the AirLand Battle.

CW3 Ben Fenhagen is assigned to the 557th Maintenance Company in Germany. He was the CCE Project Officer in the Directorate of Combat Developments at the U.S. Army Engineer School, and has served in various maintenance management positions. CW3 Fenhagen has an associate of science degree and is a graduate of the Warrant Officer Senior Course.

Engineer Problem



Specification for a project requires 800 LCY of sand and gravel. The loading unit is a 2½-cubic yard loader, with a cycle time of 50 seconds and an equipment/operating efficiency factor of .65. Hauling units will be 5-ton dump trucks with a cycle time of 12 minutes from the stockpile to the project site (reference FM 5-34, Chap 12-4).

REQUIREMENT 1: How many 5-ton dump trucks will be needed to keep the loader at maximum operations?

REQUIREMENT 2: How many hours will it take to haul the sand and gravel to the project site?

A "team" constructing an M4T6 deck balk bridge with intermediate support. (U.S. Army photo.)

Building A Team

by Dandridge M. Malone

War isn't a game, but thinking about games can sure help you learn about war.

For example, think about a football team. Think about what it does and how it operates. Then see if you can think of examples that show how a football team is like a unit on the battlefield. That ought to give you a good idea of how teamwork works, on either the playing field or on the battlefield.

But how do you build a team? Well, first, with an overall team-building strategy, and second, using one of those many specific principles of leadership that tell you to train your men as a team.

Fire team leaders build teams with their subordinate soldiers. Squad leaders and above build teams with their subordinate leaders and their teams. In either case, there is one simple overall leadership strategy for building a team. It is an overall way a team operates, not a specific instruction, and it has two requirements.

First, a leader must constantly, on a daily basis, do and say things that will convince each individual team member that he is an essential part of the whole team. He must know that other individuals depend upon him to get their work done and that only with his help will the whole team get its work done.

The second requirement of the strategy is that a leader must do and say things to convince the individual team members that their wants, needs, hopes and goals are tied to the team's performance, output and work. Each individual team member will usually operate in his own best interest. He'll do what he thinks is best for him. That doesn't sound too admirable, but it's a fact of human nature. In building a team, a leader has to convince each team member that the best way for him to get what he wants is through what the team does.

In essence, this team-building leadership strategy says:

- Convince each team member that the other team members and the team as a whole are dependent on him.
- Convince him that, even as an individual, much of the whole business of reward and punishment is tied to his team's output and performance.

Building the complex team that a battlefield requires is tough. A leader can't get it by asking for it or by just giving an order. It takes time, careful planning, and the sixth principle of leadership: "know your soldiers and what's inside each one."

Beyond general strategy, there is no step-by-step procedure practical for company-level leaders to use. But there are about ten good team-building techniques stemming from experience and research.

They have worked for hundreds of years and will work for captains, lieutenants, and sergeants today.

Use drills.

The best way to build the teamwork a unit needs is by using drills. Dismounted drill is good, but the best drills for building teamwork are spelled out in the ARTEPs. If a unit can't train in the woods, then it should walk through an ARTEP on an open field. If a unit can't do that, then it should try a blackboard, or a terrain model, or a map.

Drills must always be critiqued. The team's performance and how each individual team member contributed (or failed to contribute) to the team's performance must be discussed. The specific places where the coordination and the timing of individuals and teams worked and didn't work should also be critiqued.

Use stress.

High stress and heavy pressure applied to the team will build teamwork. That's a fact. The trick, though, is to do it right. Events, exercises, and activities that demand maximum effort by the team and by each team member will build teamwork. Add danger and that teamwork gets even stronger. The high stress of battle binds teams together so well—sometimes in just a few hours—that they continue to have annual reunions for years after the war.

In training, a unit should get as close to battlefield stress as it can. In the absence of a war, try a 100-mile road march; or run 10 miles with weapons, helmets, and LBE; or climb a mountain; or run an extremely challenging non-stop, day-and-night, 24-hour battle drill over the worst terrain you can find. Do any or all of these high stress events as a team. Then, later, start listening for the bragging and the war stories about "Us." It will work. Guaranteed!

Work by teams.

Get tasks done by teams, rather than by "details". You, First Sergeant, can do a lot about this. Next time the battalion tasks you to provide a "10-man detail and one NCO," send a fire team with its own team leader *instead* of a detail. Chances are good that half as many men, working as a team, can do twice as much work in half the time. Bet on it. And if you're even smarter, you'll let the team know you bet on them.

Leave teams together.

Whenever there are formations, leave teams together. "Break off and fill it in back there!" may make the platoon formation look better, Lieutenant, but you're breaking up a team. How units work is more important than how they look.

Whenever you, Sergeant, must form your men, brief your men, move your men, work your men, critique your men, feed your men or billet your men, do it the same way as if you had to fight with your men on the battlefield. Do it as a team.

You can tell your troops, "Everyone be at the motor pool at 1300 to clean the tracks." That *may* get them there by 1300, but if you do it that way, Platoon Sergeant, you've just lost one of those valuable daily opportunities to keep working on teamwork. Instead, form your soldiers as a squad in the company area and march them to the motor pool in step. Stand them at ease, give them their instructions with something similar to a brief five-paragraph field order (including mission standards). Supervise the fire team leaders, keeping the whole squad working until the whole job is done. Then call them to formation again, critique their performance as a team, march them back to the company area, and only then release them.

If you, as the leader, can keep your subordinates working and living as a team in their daily activities, the result of those ARTEP drills will automatically improve; and so will that unit we call "the company" when it fights on the battlefield.

Move men on manning boards, not names.

On the wall in the orderly room or in the company commander's office, there should be a manning board. It should look like nothing more than perhaps a chart covered with acetate and filled in with a grease pencil. This chart can be the main tool for building and maintaining teamwork.

The first sergeant and the platoon leaders will make the primary recommendations about who goes where, but the company commander will make the decisions. Never move a name without first thinking about the effect on teamwork and the team. When you rearrange names in an attempt to balance strength figures, you may be doing the same thing the lieutenant does when he evens up his platoon formation. The board may look better, but the unit may not be as effective because you've unintentionally destroyed some of its teamwork power, some of that "extra."

Each time you move a name, what you're really doing is moving a man, and you're moving him out of his family. More importantly, when you move him, you're moving a part of something bigger. If that something bigger is a smooth functioning team, then what you may be doing is taking out the carburetor. And a carburetor can't be replaced with an oil pump. As a general rule, hold manning board moves to an absolute minimum, and always first consider the effect the soldier has on that team.

Talk team language.

There is a simple guaranteed way which all leaders can build teamwork. They should simply start using the team words "we, us, and our," instead of, "I, me, and my." When a leader starts leading by example with his language, his followers will follow. And they'll start talking and thinking more about "us" than about "me". The first two letters in U.S. Army are "US" and the last two are "my." Think about it. It isn't a bad philosophy.

Build team reputation.

Any man worth a damn will work hard to live up to his reputation. So will a team. Whenever a team does something that is both unusual and good, and when the members do it as a team, the leadership of the whole unit should know about it. When this happens three or four times, the word will get back to the team. Then they'll find out that they do have a reputation to live up to.

Reward or punish the team.

Whenever a leader supervises a task that requires a high degree of teamwork (like maybe an ARTEP) he should try to gear his supervision, criticism, reward, and punishment to what the team does more than to what the individuals do. Each individual should clearly understand that what he wants most (or maybe wants least) should depend more on the team rather than on him.

Punishing a whole team is extremely effective, but it should be done very carefully. A whole team should be punished when all the "hands-offs" are too sloppy or too slow, when there's no trust among the parts, or when all the parts get to thinking more about me than about us.

Set the example.

Next to drill, the best thing for building teamwork is that all-powerful, all-purpose leadership tool that has been discussed so many times—the fifth principle of leadership: "Set the example."

If you're a squad leader, you probably want your squad members to believe that the squad's mission is the most important thing. If you do want them to feel this way, then you must show them that for you as the squad leader, the platoon's mission is the most important thing there is.

Also if you're a squad leader, never complain about the platoon's mission or about the platoon leader when you're with your squad. If you do, they're going to follow your example and complain about the squad's mission and about you. Do you want your followers to cooperate, work together, and trust each other? Then show them by example that that's exactly how you work with other squad leaders. From the motor pool to the battlefield, in any situation, followers will do as their leaders do. Good or bad, that's the plain chemistry of followership.

Emphasize differences.

Find out what makes one team different from the other, and keep emphasizing those differences. It may be the kind of work they do, or where they do it, or when they do it—whatever makes them different from other teams. This is another way of telling team members that their team is something special, something different, something important.

Want to build teamwork in your company, Captain? Well, one thing that's always different in any unit is the unit's history. Send a letter through channels and find out what your company did in the last war or two. Then tell the troops about their team at war and how it fought in wars in the past. No lectures, just a talk and some stories. Do this two or three times covering two or three wars and watch what happens with teamwork.

There now, you've got a simple strategy and some simple advice for building a team. All of them are easy, common sense things to do. Will they work? Well, let's return to the football game where we started. Find a team that nearly always wins. Research it a little. Find out how it works internally and what the coach does to make it work. What you'll find is the same strategy and most of these same pieces of advice that I've provided.

Adapted from the article appearing in the November-December 1983 INFANTRY journal.

Dandridge M. Mallone, a retired infantry colonel, has written numerous articles, books, and technical reports. He has a master's degree in social psychology from Purdue University and has completed several military schools, including the Armed Forces Staff College. He served in staff and faculty assignments at the U.S. Army Command and General Staff College, the U.S. Military Academy, and the U.S. Army War College.

Engineer Solution

Requirement 1.

a. First, calculate the loader output. Table 12-4 shows 180 LCY/HR for a 2½-cubic yard loader. Therefore, loader output is calculated as follows:

Loader Basic Production x Efficiency Factor = Loader Production

180 LCY/HR x .65 = 117 LCY/hr

b. Secondly, estimate the hauling requirements.

$$N = 1 + \frac{T}{L}$$

N = number of trucks required

T = travel time (minutes)

L = loading time (minutes)

1. $$\frac{\text{Loader Output}}{\text{Dump Size}} = \frac{117\ \text{LCY/hr}}{5\ \text{cy}}$$

= 23.4 LCY/hr or 23.4 Truck Loads/hr

$$T = \frac{\text{MIN/hr Working}}{\text{\# Loads of material/hr}} = \frac{60\ \text{min/hr}}{23.4/\text{hr}} = 2.56 \text{ minutes loading time}$$

$$L = \frac{\text{Dump Travel Cycle Time}}{\text{Loading Time/Dump}} = \frac{12\ \text{min}}{2.56\ \text{min}} = 4.68 \text{ dumps/cycle}$$

2. Since $N = 1 + \frac{12\ \text{min}}{2.56\ \text{min}}$

N = Extra dump + Dump
= 1 + 4.68 = 5.68 6 days

Requirement 2.

Time it will take to haul materials to the project site is calculated as follows:

$$\frac{\text{Material to be moved}}{\text{Material to be moved/hrs}}$$

$$\frac{800\ \text{LCY}}{117\ \text{LCY/hr}} = 6.83 \text{ Hours}$$

Battalion Command

An After Action

by COL Thomas Jones,
MAJ(P) Lee A. Peters
and
MAJ Kenneth L. Davidson

Battalion Commander, is one of the most revered, demanding and enjoyable command positions in the Army. However, as rewarding and career enhancing as the position can be, it can also be the waterloo of many officers who are unprepared to handle the myriad tasks that the job encompasses.

As important as the job is to the structure and functioning of the Army, very limited, practical guidance is given to a new battalion commander in the Army Reserve. Possibly the theory is that an officer who has formerly commanded a company, or other such unit and was successful will apply the same learned and inherent skills and be successful at battalion level.

Not necessarily! Battalion command comes with a whole different set of demands, responsibilities, and objectives. Many of the things that worked at company level do not work at battalion and vice-versa.

I was the commander of the 972nd Engineer Battalion (Combat), from late 1979 to the summer of 1982. My battalion was not different from most other Army Reserve Battalions. It had a battalion headquarters and headquarters company at Fort Benjamin Harrison, IN, and line units located in three central Indiana cities.

After my successful command, I reflected on why my command was successful while other commanders, who otherwise had good credentials, were only partially successful, and some failed miserably. I also pondered on what I could have or should have done to be even more successful in juggling those many command priorities.

From this thoughtful reflection and from review by former staff members, we developed a list of things which we perceived were items done correctly. We believe that if a new commander followed this "checklist for success" he could start his tenure as battalion commander in a running mode rather than suffering the tribulations of a hit or miss beginning, which may mean dropping some of those juggling priorities and may mean succeeding or failing as a commander.

Checklist for Success

• Fully use your command sergeant major.

The battalion was blessed with a very fine and very active command sergeant major who knew his job. This enabled the commander to use the NCO chain-of-command and to delegate NCO development and training to the sergeant major and to his first sergeants. For example my command sergeant major, CSM Moody, was given total responsibility for the "prep train" program in which the battalion participated. It introduced new soldiers to the Army prior to entry on active duty for initial training.

Using the CSM, as he really should be used, gave the NCOs a flow of formal and informal communication; included them in the functioning and decision making of the headquarters; and, most of all, gave the commander a close supportive and confidential personal resource.

• Completely use the services provided by the Army readiness groups.

For the 972nd this service was offered by the readiness group at Fort Knox and proved very beneficial in most areas. The Engineer team spent many hours at both their home station and at annual training providing expert assistance. The concept of "training the trainers" was used in training exercises without troops (TEWTS) and provided key unit members professional and current training so they could in turn train the personnel within their respective units.

• Use battalion training conferences.

These conferences were held to plan the annual training program for the battalion using the Battalion Training Management System (BTMS). Participants usually included the battalion commander and his staff and the unit commanders along with their first sergeants, training officers, and training NCOs. A lot of preparation took place prior to the conference, a one day meeting held away from the battalion headquarters if possible. At the meeting, the yearly training plan was discussed and the battalion's yearly training circular was published from the results of the meeting.

• Emphasize the importance of the line units.

We had to ensure the staff and the headquarters personnel understood the staff and that their personnel supported the line units. This applied to all areas, including allocating the bulk of the man-day funds and additional training assemblies (ATA) to the line units instead of using them at the headquarters. Also, the staff was frequently sent to the line companies to give assistance instead of being sent to inspect. The feeling of giving help rather than passing judgment was installed within the headquarters personnel.

• Stabilize your full-time personnel.

The people who keep the battalion functioning during the non-drilling hours are your full-time personnel, the unit technicians. In the 972nd, most of the civilian positions were converted to military positions. This military conversion proved to be extremely beneficial. It stabilized the high turnover and allowed personnel to be trained and to become very proficient in their positions.

At annual training the unit administrative supply technicians were consolidated together with the staff administrative specialist in a technician personnel and administrative center at battalion, where they received training and were able to pool their expertise to better serve the soldiers of the entire battalion.

• Clearly establish the commander's policies.

Command policy letters were sent to each unit and staff section. These letters were required to be maintained in a separate, readily available file. They clearly stated the commander's objectives and gave the unit commanders a reference on most key subjects.

• Use known personnel qualities, even for short periods.

Make full use of your personnel's strong points even though you know you will be losing them in the near future. Taking advantage of personnel strong points for even the shortest time periods still gives the unit some reward and can often lead to accomplishing important tasks.

As an example, we had an officer with a strong command background who wanted to join the 972nd, but we knew he would transfer out of the unit within a year. There was a need for a strong commander in one of the line companies, however, to help solve some internal problems. This officer was put in command and used his experience to "straighten-up" the unit. The unit was left in a much improved condition and enabled a capable, but less experienced officer, to take command of a good unit. If the strong qualities of this short term commander were not fully used it may have taken a very long period to correct conditions within the company.

• Be willing to take risks with your personnel.

Allow your leaders to perform on their own as much as possible. Allow them to make mistakes. Be prepared to step in and bring things back under control without accusing individuals if the situation gets out of control. However, do identify the lesson to be learned.

This proved to be a very effective teaching method and also allowed the commander to see fairly quickly what the strong and weak points were within his commanders and staff.

Also, recognize people who do good work, especially under the conditions present in the USAR system. Recognition pays quality dividends to the person, to the unit, and to the commander.

Possible Improvements

One management tool which we used, but later felt that it could have been more effective was the organizational effectiveness (OE). Readiness group Fort Knox organizational effectiveness consultants were invited to work with the battalion and provided very useful feedback on the conditions within the battalion. However, only limited advantage was taken.

New commanders should become familiar with organizational effectiveness and the services which their supporting readiness group is prepared to provide. The benefits are great for limited investments of time and energies.

The following checklist reflects items which we feel are the key areas in helping new battalion commanders to become successful. If a commander follows this guidance he stands a much better chance of a successful command.

Command Philosophy

I operated my command with several open commander's philosophies.

• Don't allow your mistakes to get so serious that you can't correct them. Be astute and committed to saving a man from falling when you see him stumble.

• Set your priorities and hold fast to them. Make sure everyone is working with the same set of priorities. Pass the Combat Readiness Inspection (CRI); obtain a satisfactory 1-R Reserve Annual readiness; emphasize logistics; improve strength and conduct dynamic training.

• Stabilize your key personnel as much as possible.

• Emphasize the "big picture"—the world military viewpoint.

• The battalion commander is the training manager for each unit commander, XO, CSM, and Supervising Staff Administrative Assistant (SSAA).

• Have your leaders play together so they can more effectively work together, for example, a dining in.

• Emphasize traditions (Army and unit).

• Delegate to subordinates (the executive committee is the CSM, the XO, the S-3, and the SSAA).

• Develop your staff and people.

• Manage your highers—over 700 miles away.

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MAJ(P) Lee A. Peters, USAR, heads Construction Support Services, Inc., in Indianapolis. He has a bachelor's degree in chemistry and has masters' degrees in civil engineering and management from Purdue University and also serves as maintenance officer for the 123rd ARCOM. During the TEWT training, he was the executive officer for the 972nd and 169th Engineer Bns. MAJ Peters is a registered professional engineer in Indiana.

MAJ Kenneth C. Davidson, USAR, is an ROTC instructor at the University of Nevada in Las Vegas. He was the supervising staff administrative assistant of the 972nd Engineers during TEWTS. He has a master's degree in business administration from Georgia State University and is a graduate of the Administration Officer's Advanced Course.

enemy will reinforce those obstacles and predict the structure of the battlefield. The G-2 also analyzes enemy routes into the flanks of our attack so that Engineer terrain reinforcement can strengthen our flank security, and, finally, he examines deep enemy avenues for counterattack to recommend FASCAM targets to isolate the battlefield.

Engineer battalion headquarters should begin detailed planning for the hasty defense before the attack so that resources are readily available when the objective is seized. The G-2 then recommends the Engineer task force to weigh the main attack, provide flank security, consolidate the objective, and keep MSRs open.

During the execution of the attack, the division Engineer monitors all obstacles encountered. His analysis of his entire Engineer effort is included in the G-2's enemy assessment. He ensures obstacle data is distributed to follow-on forces and sends corps Engineers forward to clear bypassed obstacles, to replace tactical bridges, and to reopen MSRs. He must ensure prepositioning of key assets, such as bridging, so that major obstacles may be overcome with minimum loss of momentum.

In the defense, the division Engineer must clearly understand how the commander envisions the battle being fought so that he can organize Engineer support to accomplish two missions—reinforcing the primary threat avenue of approach and providing economy of force on less likely avenues of approach.

He must know where penetrations are expected and allowed, and where they must be prevented. He must know which kill zones are to be structured and which avenues of approach are viewed as the greatest threat. He must also know where the commander expects to counterattack so that lanes can remain open or roads and bridges can be reinforced, and what key targets to reserve for division execution. He must understand the expected deep battle to recommend family of scatterable mines (FASCAM) to disrupt the second echelon and to help structure kill zones for deep thrusts of air or ground forces.

Obstacle zones and obstacle-free lanes on the division obstacle overlay depict the commander's vision of how the division sector will be held and provide the guidance which subordinate commanders need to structure the battlefield in their sector. They are equivalent to the coordinated fire lines or restricted fire areas on the fire support overlay. Very few targets appear on the division obstacle overlay. Individual targets are reported from task forces once they are sited on the ground. The final obstacle overlay is a combination of the commander's concept and the subordinate units' plans of execution.

The G-2 must always revise his terrain analysis based on this structured battlefield. If, for example, significant effort has blocked the primary avenue of approach, then it can no longer be viewed as the greatest threat. Forces must be allocated based on the structured battlefield, not the natural battlefield. This is why the critical question the division Engineer must answer is, "From where does the commander want the enemy to come?".

In executing the defense, the division Engineer monitors battlefield preparation. He monitors equipment status and the flow of Class IV and Class V, ensuring that time, and not materials, is the limiting factor in defensive preparation. His critical task is to tell the commander the status of each obstacle system. Although individual obstacles are seldom of consequence at division level, confirming that the terrain has been changed to meet the commander's concept verifies that maneuver units are correctly positioned to fight the battle.

The division Engineer monitors FASCAM emplacement to ensure obstacles in counterattack lanes have detonated prior to friendly movement. By this time the corps Engineer group and battalion headquarters, in coordination with maneuver unit representatives, have already begun to site obstacles on the ground for the next series of battle positions in depth.

How the division Engineer uses his resources to accomplish his missions varies with each division. There is no doctrine. We, at the 1st Engineer Battalion, have found it best for the division Engineer to locate near the division tactical command post (DTAC) when fighting today's battle, while the assistant division Engineer (ADE) is the staff planner at division main command post (DMAIN) for tomorrow's battle. The ADE coordinates with adjacent divisions and with the Engineer brigade supporting the corps. He assesses future requirements and makes requests for additional support.

Once corps Engineers enter the division sector, they coordinate directly with the 1st Engineer Theater Operation Center (TOC), which locates within two kilometers of DTAC and ties into the multichannel switchboard by land line. The TOC tracks the current status of all engineer work within the sector, including unit positions, Class IV and Class V status, equipment status, obstacle execution (defense) and enemy obstacles (offense).

When the division Engineer is not present in the DTAC, a liaison officer (LNO) is positioned there to ensure the current status is available for the close battle, deep battle, and MSRs and positions in depth. The division Engineer returns to DMAIN to advise on Engineer support for significant changes in operations such as initial defensive planning, river crossings or major contingencies.

The division Engineer wears his staff hat far more than his command hat in wartime. He advises and coordinates a brigade-size force of combat multipliers whose capabilities must be fully used if the combined arms team is to fight and win.

LTC Nahas is Commander, 1st Engineer Battalion, 1st Infantry Division (Mech). His previous troop assignments include executive officer of the 2nd Battalion 28th Infantry and S-3 of the 12th Engineer Battalion, both in the 8th Infantry Division (Mech). He is a graduate of the Command and General Staff College and he is a registered professional Engineer in Virginia.

Engineer Command Update

Active Army

7th Engineer Brigade
COL Paul Cerjan
Kornwestheim, Germany

130th Engineer Brigade
COL John Sobke
Hanau, Germany

2nd Engineer Group
COL Ernie Harrell
Camp Coiner, Korea

18th Engineer Brigade
COL Carl Magnell
Karlsruhe, Germany

36th Engineer Group
COL Michael Ward
Ft. Benning, GA

20th Engineer Brigade (C) (ABN)
LTC James Lyle
Ft. Bragg, NC

937th Engineer Group
COL Jerry Hubbard
Ft. Riley, KS

LTC Jerry Sinn
1st Engineer Bn., 1st Inf. Div.
Ft. Riley, KS

LTC Jack LeCuyer
7th Engineer Bn., 5th Inf. Div.
Ft. Polk, LA

LTC Russ Furhman
10th Engineer Bn., 3d Inf. Div.
Kitzingen, Germany

LTC Mike Norris
15th Engineer Bn., 9th Inf. Div.
Ft. Lewis, WA

LTC John Morris
23rd Engineer Bn., 3rd Armd. Div.
Hanau, Germany

LTC Philip Shoemaker
39th Engineer Bn. (CBT) (CORPS)
Ft. Devens, MA

LTC Mike Thuss
62nd Engineer Bn. (CBT) (HVY)
Ft. Carson, CO 80913

LTC Jim Craig
82nd Engineer Bn. (CBT) (HVY)
Bamberg, Germany

LTC Mel Lynch
249th Engineer Bn. (CBT) (HVY)
Kneilingen, Germany

LTC Clint Willer
326th Engineer Bn. (A ASSLT)
Ft. Campbell, KY

LTC Charles S. Thomas
2nd Engineer Bn., 2nd Inf. Div.
Camp Casey, Korea

LTC Charles Olson
5th Engineer Bn. (CBT) (CORPS)
Ft. Leonard Wood, MO

LTC Charles J. Mills
11th Engineer Bn. (CBT) (HVY)
Ft. Belvoir, VA

LTC Robert J. Greenwalt
16th Engineer Bn., 1st Armd. Div.
Furth, Germany

LTC Mike Diffley
27th Engineer Bn. (ABN)
Ft. Bragg, NC

LTC Rick Shuler
43rd Engineer Bn. (CBT) (HVY)
Ft. Benning, GA

LTC Jim Simms
65th Engineer Bn., 25th Inf. Div.
Schofield Bks, HI 96857

LTC Mark Potter
84th Engineer Bn. (CBT) (HVY)
Schofield Bks, HI

LTC John Horne
293rd Engineer Bn. (CBT) (CORPS)
Balmholder, Germany

LTC Walt Ivanjack
547th Engineer Bn. (CBT) (CORPS)
Darmstadt, Germany

LTC Hank Miller
3rd Engineer Bn., 24th Inf. Div.
Ft. Stewart, GA

LTC Jack LeCuyer
7th Engineer Bn., 5th Inf. Div.
Ft. Polk, LA

LTC David E. Shaver
12th Engineer Bn., 8th Inf. Div.
Dexheim, Germany

LTC Pete Sowa
17th Engineer Bn., 2d Armd. Div.
Ft. Hood, TX

LTC Joel Crain
29th Engineer Bn. (TOPO)
Shafter, Korea

LTC Doug Brown
44th Engineer Bn. (CBT) (HVY)
Camp Mercer, Korea

LTC Bill Travbel
76th Engineer Bn. (CBT) (HVY)
Ft. Meade, MD 20755

LTC Floyd Griffin
92nd Engineer Bn. (CBT) (HVY)
Ft. Stewart, GA

LTC Church McCloskey
299th Engineer Bn. (CBT) (CORPS)
Ft. Sill, OK

LTC Fred Ernest
548th Engineer Bn. (CBT) (HVY)
Ft. Bragg, NC

LTC Thomas Farewell
4th Engineer Bn., 4th Inf. Div.
Ft. Carson, CO

LTC Leo Laska
8th Engineer Bn., 1st Cav. Div.
Ft. Hood, TX

LTC Mike Kuehn
13th Engineer Bn., 7th Inf. Div.
Ft. Ord, CA

LTC Timothy E. Daly
19th Engineer Bn. (CBT) (CORPS)
Ft. Knox, KY

LTC Fohn Morgan
30th Engineer Bn. (TOPO)
Ft. Belvoir, VA

LTC Hamp Conley
46th Engineer Bn. (CBT) (HVY)
Ft. Rucker, AL 36362

LTC J ohn Wildenberg
78th Engineer Bn. (CBT) (HVY)
Ettleingen, Germany

LTC Joe Larremore
94th Engineer Bn. (CBT) (HVY)
Darmstadt, Germany

LTC Larry Izzon
307th Engineer Bn. 82nd Abn Div.
Ft. Bragg, NC

LTC Dan Waldo
549th Engineer Bn. (SVC)
Schwetzingen, Germany

LTC Charles Olson
5th Engineer Bn. (CBT) (CORPS)
Ft. Leonard Wood, MO

LTC Charles Cowan
9th Engineer Bn. (CBT) (CORPS)
Aschaffenburg, Germany

LTC George Meador
14th Engineer Bn. (CBT) (CORPS)
Ft. Ord, CA

LTC Gary Morgan
20th Engineer Bn. (CBT) (CORPS)
Ft. Campbell, KY

LTC Jim Lyles
34th Engineer Bn. (CBT) (HVY)
Ft. Riley, KS

LTC Bill Malone
52nd Engineer Bn. (CBT) (HVY)
Ft. Carson, CO 80913

LTC Milton Hunter
79th Engineer Bn. (CBT) (HVY)
Karlsruhe, Germany

LTC John Pierce
237th Engineer Bn. (CBT) (HVY)
Heilbronn, Germany

LTC Ed Ruff
317th Engineer Bn. (CBT) (CORPS)
Eschborn, Germany

LTC Billy Ricks
559th Engineer Bn. (SVC)
Hanau, Germany

LTC Sam Raines
563rd Engineer Bn. (SVC)
Kornwestheim, Germany

LTC John Mills
565th Engineer Bn. (SVC)
Nevrevt, Germany

LTC Wayne Murphy
588th Engineer Bn. (CBT) (HVY)
Ft. Lewis, WA

LTC Ray Brakham
Composite Engineer Bn.
Ft. Bragg, NC

TRADOC

COL Don Barber
USA Engineer School Brigade
Ft. Belvoir, VA

COL Leo Holland
2nd AIT Brigade
Ft. Leonard Wood, MO

COL William M. Shepherd
4th AIT Brigade
Ft. Leonard Wood, MO

COL Ronald R. Primer
SPT Brigade
Ft. Leonard Wood, MO

LTC Frank Reller
1st Battalion, 2nd Brigade
Ft. Leonard Wood, MO

LTC Dave Lindsay
4th Engineer Battalion, 4th Brigade
Ft. Leonard Wood, MO

LTC James King
2nd Battalion, 2nd Brigade
Ft. Leonard Wood, MO

LTC Hal Alvrod
2nd Battalion, 3rd Brigade
Ft. Leonard Wood, MO

LTC Barry Levine
4th AIT Battalion, 2nd Brigade
Ft. Leonard Wood, MO

LTC Bill Boutin
5th Battalion, 3rd Brigade
Ft. Leonard Wood, MO

LTC Tom Jacobus
2nd AIT Battalion, 4th Brigade
Ft. Leonard Wood, MO

LTC Ken Pryor
2nd Engineer Battalion
Ft. McClellan, AL

LTC Jim Jenkins
3rd Engineer Battalion, 4th Brigade
Ft. Leonard Wood, MO

LTC Sanford Griffin
3rd Engineer Battalion, USAESB
Ft. Belvoir, VA

LTC John Carny
1st Engineer Battalion, USAESB
Ft. Belvoir, VA

LTC Robert Baker
10th Engineer Battalion, 2nd Brigade
Ft. Jackson, SC

LTC Paschala Aquino
1st Engineer Battalion, 1st Brigade
Ft. Jackson, SC

LTC Michkaud
15th Engineer Battalion, 4th Brigade
Ft. Knox, KY

Army Reserve

412th Engineer Command
MG Robert E. Louque, Jr.
Vicksburg, MS

416th Engineer Command
MG Maxwell Baratz
Chicago, IL

411th Engineer Brigade
COL Roger L. Kresge
Brooklyn, NY

420th Engineer Brigade
BG Alvin W. Jones
Bryan, TX

315th Engineer Group
New Cumberland, PA
COL Donald D. Emig
330th Engr Bn. (CBT) (CORPS) - MAJ(P) James Carrol
365th Engr Bn. (CBT) (HVY) - LTC James F. Lemp

353rd Engineer Group
Oklahoma City, OK
COL Paul Revis
489th Engr Bn. (CBT) (CORPS) - LTC Jimmie Dyer
980th Engr Bn. (CBT) (HVY) - LTC William Long

385th Engineer Group
Ft. Snelling, MN
COL William H. Thom
367th Engr Bn. - LTC Allen L. Beeler
397th Engr Bn. (CBT) (CORPS) - LTC James Oleson
961st Engr Bn. (CBT) (HVY) - LTC John M. Schuster

329th Engineer Group
Brockton, ME
COL Thomas C. Stones
483rd Engr Bn. (CBT) (CORPS) - LTC Eugene Tour
368th Engr Bn. (CBT) (HVY) - LTC Robert Rapp

364th Engineer Group
Columbus, OH
COL James C. Myers
478th Engr Bn. (CBT) (CORPS) - LTC Dennis Grant
983rd Engr Bn. (CBT) (HVY) - LTC Gary Liebenthal

493rd Engineer Group
Dallas, TX
COL Jerry Selly
245th Engr Bn. (CBT) (CORPS) - LTC David Sigler
430th Engr Bn. - LTC Michael L. Griffith
871st Engr Bn. (CBT) (HVY) - LTC John M. Gosdin

348th Engineer Group
Birmingham, AL
COL Richard B. Burleson
844th Engr Bn. (CBT) (HVY) - MAJ(P) James Sullivan
926th Engr Bn. (CBT) (HVY) - LTC Harry D. Waddle

372nd Engineer Group
Des Moines, IA
COL Max L. Schardein
398th Engr Bn. (CBT) (HVY) - LTC Bruce B. Wands
863rd Engr Bn. (CBT) (HVY) - LTC Jack H. Kotter
972nd Engr Bn. - LTC James L. Bauerle

926th Engineer Group
Montomery, AL
COL Julian F. Botts
467th Engr Bn. (CBT) (CORPS) - LTC Charles Ingram

National Guard

16th Engineer Brigade
BG Roland Bowman
Columbus, OH

30th Engineer Brigade
COL(P) Furman P. Badenheimer, Jr.
Charlotte, NC

35th Engineer Brigade
BG Charles F. Blattner
Jefferson Bks, MO

194th Engineer Brigade
COL(P) Lytle Brown
Nashville, TN

46th Engineer Group
Flint, MI
COL Elon M. Pearson
107th Engr Bn. (CBT) (CORPS) - LTC Dougovito
207th Engr Bn. (HHD) - MAJ John J. Nelson
507th Engr Bn. (HHD) - LTC Edward E. Eckart

115th Engineer Group
Murray, UT
COL Dee Ray Russon
1457th Engr Bn. - LTC Joseph Ford

168th Engineer Group
Vicksburg, MS
COL Jerry M. Keeton
223rd Engr Bn. (CBT) (HVY) - LTC Dennis R. Self
890th Engr Bn. (CBT) (HVY) - LTC Billy R. Barton

225th Engineer Group
Pineville, LA
COL Charles R. Lindsey
205th Engr Bn. (CBT) (HVY) - MAJ Wilson C. Maloz
527th Engr Bn. (CBT) (HVY) - LTC Charles Partin
528th Engr Bn. (CBT) (HVY) - LTC Edmund Giering
769th Engr Bn. (CBT) (HVY) - LTC Lester Schmidt

265th Engineer Group
Marietta, GA
COL Jack D. Cooper
560th Engr Bn. (CBT) (CORPS) - LTC Michael Sims
878th Engr Bn. (CBT) (HVY) - LTC Thomas Williams

105th Engineer Group
Winston Salem, NC
COL Harvey L. Poole
505th Engr Bn. (CBT) (HVY)

109th Engineer Group
Rapid City, SD
COL Leroy Beringer
109th Engr Bn. (MAINT) - LTC Robert P. Daane
137th Engr Bn. (MAINT) - LTC Richard P. Gross
153rd Engr Bn. (CBT) (CORPS) - LTC Robert Bensom

134th Engineer Group
Hamilton, OH
COL Raymond E. Trickler
216th Engr Bn. (CBT) (CORPS) - LTC Harlan F. Hess
1138th Engr Bn. (CBT) (CORPS) - LTC Allen Wright
1140th Engr Bn. (CBT) (CORPS) - LTC David R. Moll

176th Engineer Group
Richmond, VA
COL Ralph E. Hickman
276th Engr Bn. - LTC E. Gilman
1030th Engr Bn. (SVC) - LTC Lloyd R. Scott

240th Engineer Group
Waterville, ME
COL Roscoe Tibbetts
153rd Engr Bn. (CBT) (HVY) - MAJ Richard Knight
262nd Engr Bn. - LTC Norm Girouz

308th Engineer Group
Pittsburg, PA
COL Samuel P. Contacos
429th Engr Bn. (CBT) (HVY) - LTC Mellillo
458th Engr Bn. (CBT) (HVY) - LTC Rodney Ruddock
463rd Engr Bn. (CBT) (HVY) - LTC Walter Ferguson

111th Engineer Group
St. Albans, WV
COL Manual G. Goble
1092nd Engr Bn. (CBT) (CORPS) - LTC Casto

164th Engineer Group
Bismark, ND
COL Ronald Affeldt
141st Engr Bn. (CBT) (CORPS) - LTC Robert Schulte
164th Engr Bn. (CBT) (CORPS) - LTC Larry Dennis
231st Engr Bn. (SVC) - LTC Virgil A. Rude

221st Engineer Group
Buffalo, NY
COL Frank J. Ferretti
152nd Engr Bn. (CBT) (HVY) - LTC Richard Fidurski

264th Engineer Group
Eau Claire, WI
COL Elmer O. Simpson
426th Engr Bn. (MAINT) (HHD) - LTC Roger Brill
724th Engr Bn. (CBT) (CORPS) - MAJ Robert Trieland

416th Engineer Group
Walbridge, OH
COL Richard F. Mueller
112th Engr Bn. (CBT) (CORPS) - LTC John Jenkins
612th Engr Bn. (CBT) (CORPS) - LTC David Hering

1169th Engineer Group
Huntsville, AL
COL Andre J. Heritage
151st Engr Bn. (CBT) (CORPS) - LTC David Powell
877th Engr Bn. (CBT) (HVY) - LTC Perry R. Rolfe
1343rd Engr Bn. (CBT) (CORPS) - LTC Joel N. Pugh
145th Engr Bn. (SVC) - LTC Joseph A. Harris

- Beginning with this issue, ENGINEER will publish the "Engineer Command Update" every summer.
- Readers are encouraged to send command updates or any additional information to ENGINEER. Further unit and command information can be obtained from the "U.S. Army Active National Guard, and Reserve Engineer Units Directory," published in 1984 at Fort Belvoir, VA.

Commissioned Officers' Branch

Restructuring Specialty Code 21:

Letters notifying officers of tentative specialty code designations under the SC 21 restructure were mailed to all officers holding SC 21 during February, March and April. Officers who have not received a letter should contact CPT George Cooley, Engineer Professional Development Officer at (AV) 221-7426/27.

A system change on the Official Military Personnel File at MILPERCEN automatically converted all officers holding additional specialty (ADSPEC) 21 to SC 23 in February. Many of these officers were redesignated to another additional specialty during the recoding of individual records in April and May. (See "Restructuring SC 21" on page 31 in ENGINEER Winter 1983-84.)

Advanced Civil Schools Board:

The Engineer Branch Advanced Civil Schools Board will meet in early September to select officers for FY 85 advanced civil schooling (Master and PHD level). Officers desiring to be considered should submit applications in accordance with AR 621-1 to USAMILPERCEN, ATTN: CAPC-OPF-E, Alexandria, VA 22332. Fully-funded and partially-funded slots are available in Civil Engineering, Operations Research, Nuclear Engineering, Computer Science/Artificial Intelligence, Comptrollership, Geodetic Science, and Area Studies. Officers with questions should contact CPT George Corley, Engineer Professional Development Officer, AV 221-7426.

NCO & Enlisted Soldier's Branch

1984 E7 Selection Board:

The 1984 E7 promotion selection list was based on DA DCSPER established selection objectives by MOS. The selection objectives were calculated on projected authorizations and vacancies with the intent to minimize overstrength MOSs. The competition within the Engineer MOS was keen. The "whole person" concept was used and only those determined to be "best qualified" were selected. The board was extremely interested in primary MOS (PMOS) proficiency with troops at the E6 level, and in the narrative comments contained in the EER; with both demonstrating performance of present duty and evaluation of potential.

It is anticipated that the FY 84 Selection Boards will use selection objectives similar to those used by the 1984 E7 Board. Thus, selection rates to E8 and E9 are anticipated to be low for CMF 12, 51 and 81 due to present and projected strengths. The Engineer E7 selectee profile is shown on page 41.

1984 ENGINEER E7 SELECTEE PROFILE								
	Number Considered	Number Selected	Percent	Education	Age	Time in Service	Time in Grade	EER Weighted Average
Career Management Field 12								
Primary Zone	491	43	8.8	12.2	31.7	10.7	4.3	123.4
Secondary Zone	812	33	4.1	12.3	28.1	7.6	1.6	124.0
Total	1303	76	5.8	12.2	30.1	9.4	3.1	123.7
Career Management Field 51								
Primary Zone	328	76	23.2	12.7	33.5	12.0	4.6	122.7
Secondary Zone	409	39	9.5	12.4	29.4	9.0	2.0	123.8
Total	737	115	15.6	12.6	32.1	11.0	3.7	123.1
Career Management Field 81								
Primary Zone	107	3	2.8	14.3	35.0	11.3	5.0	123.3
Secondary Zone	75	2	2.7	13.5	31.0	8.5	2.5	124.0
Total	182	5	2.7	14.0	33.4	10.2	4.0	123.6
Overall								
Primary Zone	24602	4752	19.3	12.6	33.3	12.2	4.6	123.7
Secondary Zone	25113	2799	11.1	12.5	30.2	9.1	2.0	124.0
Total	49715	7551	15.2	12.6	32.1	11.0	3.6	123.9

Official Photograph:

Effective April 2, 1984, official photographs will no longer be a part of the microfiche Official Military Personnel Files (OMPF) for enlisted personnel. The hard copy official photograph will be used by centralized selection boards and career managers. This now requires two copies of your photograph to be forwarded to your local military personnel office for subsequent forwarding to Ft. Benjamin Harrison. The Enlisted Record Examination Center (EREC), Ft. Benjamin Harrison, will forward one copy to your career branch for inclusion in your Career Management Individual File (CMIF). Your photograph is a critical element of your OMPF. Ensure it is of top quality, current, and proper and for fit of uniform, rank, awards and decorations, and service stripes. AR 640-30, paragraph 7, establishes the *minimum* frequency requirements for submitting your photograph.

Three rangers of the 29th Ranger Battalion putting a five section Bangalore Torpedo under obstructing barbed wire prior to charging their objective. Photo taken in England August 1, 1943. (U.S. Army photo.)